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# Popular Science Monthly

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# Popular Science

Founded MONTHLY 1872

300 Pict

300 New Ideas in Automobiles — Mechanics — Wireless — Inventions

When I asked the grown-ups to judge for themselves what Xmas present they wanted —they all chose

# MURAD

# Popular Science Monthly

Waldemar Kaempffert, *Editor*

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# Stepping Off into Space

## The queer and sickening sensations that a flyer experiences when he commits himself to a life-preserver of the air

**By Major T. Orde Lees, late of the Royal Air Force**

[DOZENS *of inventors have applied themselves to the problem of providing an airplane parachute that will be as nearly perfect as possible; but it is one thing to step into space from a balloon and another from an airplane moving at more than one hundred miles an hour. When Major T. Orde Lees, late of the Royal Air Force, came to this country in order to demonstrate the efficacy of an English parachute called the "Guardian Angel," the* POPULAR SCIENCE MONTHLY *invited him to give a special demonstration for scientific purposes. The experiment took place successfully off the Statue of Liberty in New York harbor on August 28. A drop from a height of less than two hundred and fifty feet was made. This is the lowest on record from any aircraft.*—EDITOR.]

THE memory of Lufberry's tragic death still lives. Who can forget how the most daring of American fighting flyers vaulted into the air to destroy a heavy German armored machine that had been wreaking havoc for days, how Lufberry in vain poured in a hail of machine-gun bullets at his adversary, how his machine was itself struck, how he fell in flames, how he unbelted himself and leaped to his death from a height of eight hundred feet, preferring to commit suicide rather than to be broiled alive? Every thinking man asks himself then: Is there no life-preserver of the air? No way in which a man in dire extremity can save himself?

The parachute at once suggests itself. Lufberry's death typifies the end of a hundred brave flyers on the side of the Allies alone. Six thousand men, unable or unwilling to adopt Lufberry's desperate expedient, were burned to death in the air. I can speak with some authority on this subject as a late director of the parachute department of the Royal Air Force.

In view of the fact that no passenger ship is permitted to leave a port without an adequate supply of life-belts, it is utterly incomprehensible that a flying-machine, freighted with one, two, three, even fifteen passengers, is sent aloft without any provision whatever in the way of life-saving equipment—because the airplane parachute, when properly designed and constructed, has demonstrated its efficacy.

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Major T. Orde Lees has just jumped from the flying-boat. He is easily within one hundred and fifty feet of the ground, and yet, as the picture testifies, his parachute is fully open

We have been told that parachutes are too heavy for installation on machines in which ounces must be saved; but we have not been told that a serviceable parachute need not weigh more than thirty pounds. We have also been told that parachutes are expensive; but can anything be more expensive than the loss of a Lufberry? It cost the United States government about $15,000 to train a flyer during the war. The cost of the best parachute thus far developed is about $600. Cast aside all sentiment, all humanity, and consider whether $600 is too great a price to pay for the saving of a mind and a body that represent an investment of at least $15,000 for training alone. We even hear it said that pilots themselves will hear nothing of parachutes. But is it true? Has any vote ever been taken among the fifty thousand flyers of Great Britain, France, and the United States?

The Germans, at least, were not blind. In the last three months of the war they equipped most of their airplanes with parachutes. The best authorities estimate that from fifty to seventy-five per cent of the Allied aviators who leaped to death from burning machines, or who were burned alive in mid-air, might have been saved by parachutes.

The problem of equipping the airplane with a parachute is almost as old as the airplane itself. As long ago as 1913, Blériot attached a crude type of parachute to his machine — a parachute invented by Bonnet, a French canteen-keeper. Successful essays were made with this apparatus until a serious accident to Bonnet's assistant, Bourrhis, and to his pilot, Lemoine, revealed the potential danger of this type, designed as it was to drag the aviator bodily out of his machine.

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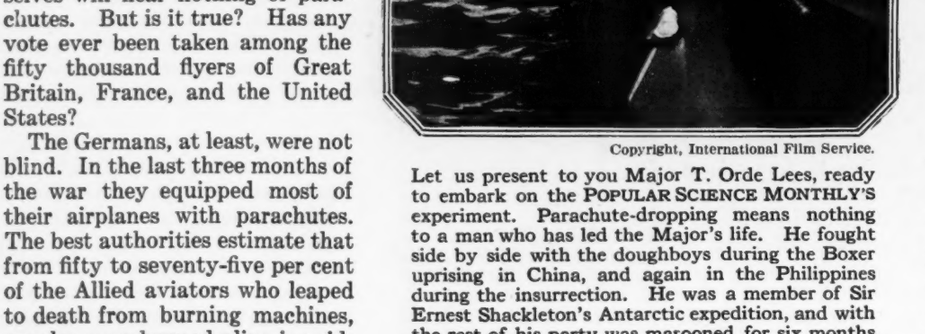
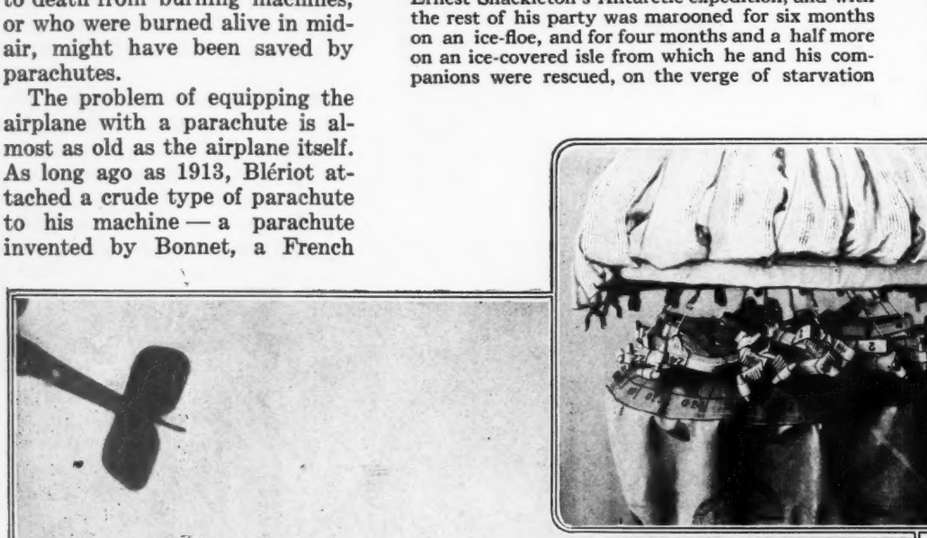
Let us present to you Major T. Orde Lees, ready to embark on the POPULAR SCIENCE MONTHLY'S experiment. Parachute-dropping means nothing to a man who has led the Major's life. He fought side by side with the doughboys during the Boxer uprising in China, and again in the Philippines during the insurrection. He was a member of Sir Ernest Shackleton's Antarctic expedition, and with the rest of his party was marooned for six months on an ice-floe, and for four months and a half more on an ice-covered isle from which he and his companions were rescued, on the verge of starvation

Before this, in 1910 to be exact, a well known English engineer, E. R. Calthrop, invented a parachute which he calls the *Guardian Angel*, and which in its latest form has been officially adopted by the British government for use on all of its airplanes. So far the British and French among the Allies are the only nations that have made the carrying of parachutes on airplanes compulsory. The failure of America to follow the British and French is certainly not to be attributed to lack of inventiveness. There are at least a dozen American airplane parachutes available, among them the Folmer-Clogg, Irvine, Floyd-Smith, Jahns, Sperry, Watkins, and Broadwick. Up to the present Mr. Calthrop's *Guardian Angel* is the most thoroughly tested of all parachutes. The *Guardian Angel* has dropped nearly two hundred men. It is doubtful whether a score of drops has been made with any of the American parachutes.

In the two hundred drops made with the *Guardian Angel* there were but two fatal accidents, and neither of these is attributable in any way to a failure of the parachute itself. One man, Boyle, was killed because the hook by which the parachute-container was attached to the airplane broke. The other man, Lieutenant Caldwell, perished because his life-line became entangled with the elevator-rocker arm of the airplane, so that an impact officially calculated at 2,150 pounds was suddenly thrown upon the harness around his body, with the result that the harness broke and Lieutenant Caldwell fell six hundred feet to his death at Dayton, Ohio, on June 11, 1919. The load was never transmitted to the parachute itself.

The problem of inventing a parachute suitable for use from an airplane resolves itself into these phases: the parachute must not entangle the rigging or any part of an airplane; its bulk when packed should not be more than one and one fifth cubic feet; and its weight not more than





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When you jump from an airplane traveling at one hundred and twenty miles an hour, this is what happens. You are literally whisked back in a flash. Then the parachute opens and you feel as if some beneficent giant were miraculously supporting you. As the upper picture shows, the rigging of the *Guardian Angel* is made of tape because it is not likely to become entangled in the pack, as is cordage

twenty-eight pounds. In fulfilling these difficult conditions, Mr. Calthrop has produced a parachute that has what is termed a positive opening. Instead of using cordage for the rigging, Mr. Calthrop adopts tapes; for thus he prevents entanglement. Each tape is folded backward and forward to form a pack in the manner of a common firecracker; the whole is secured by a rubber ring. When the pilot leaps from his machine, the tapes are pulled out always in tension, and for this reason entanglement is impossible.

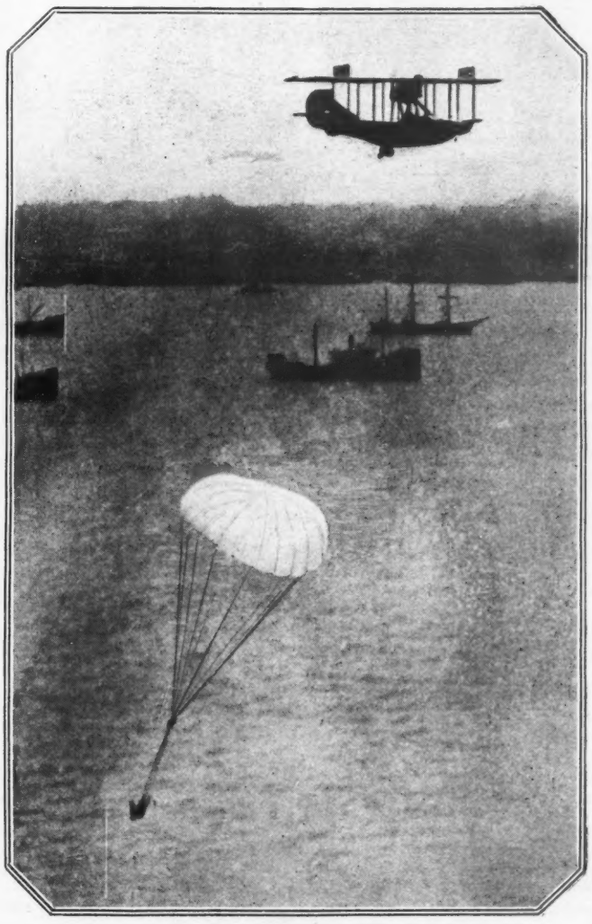
The silk body of the parachute is first carefully pleated around its periphery, reducing the parachute to a tube fourteen feet long by two feet in diameter. This tube is then packed, concertina-wise, between two aluminum disks two feet in diameter, separated from each other by a six-inch tubular spacing piece. In operation the parachute is drawn over the lower disk so that it actually leaves its container with its mouth already open, two feet in diameter.

In its complete form the container resembles a large round cake two feet in diameter. All parachutes are approximately of the same size and shape. Parachute inventions differ from one another mainly in the character of their containers, and the methods of packing.

The standard parachute is twenty-eight feet in diameter, but during the war the Germans were using parachutes from nineteen to twenty-one feet. Mr. Calthrop is now making a scientifically designed parachute of only seventeen feet in diameter. It descends with a full load at no greater speed than the twenty-eight-foot parachute. For over one hundred and thirty years we have been content with the twenty-eight-foot parachute. But a seventeen-foot umbrella, scientifically cut, can be made to serve the same purpose. The twenty-eight-foot parachute owes its inefficiency to the fluting that occurs at the periphery during flight. Mr. Calthrop's new *Guardian Angel* assumes almost the exact shape to which it is cut, the periphery being polygonal in flight; that is, a straight line is formed from one tape to the next when it is fully inflated and supporting its load. The form of the parachute was determined by wind-tunnel research based on calculations made by Major Taylor, R. A. F., a mathematician of note, at the National Physical Laboratory in London.

Far more is expected of an airplane parachute than of the huge umbrella which has been made familiar by the professional aeronaut who drops from a balloon, to the admiration of thousands, at county fairs. Remember that the balloon is almost stationary, while the airplane may be traveling one hundred miles or more an hour. It is difficult to hold up one's arm in a swiftly flying machine—as difficult, for example, as it is to prevent one's hand from being swept back when dipped into water from a fast motor-boat. The mere physical task of rising and preparing to jump is enough to give one pause. There is great danger that the parachute will be blown back along the fuselage while the aviator is sitting on the side, waiting to drop. The silk may foul and tear on some part of the machine, because it loses its forward momentum the instant it emerges and is whisked back close past the tail of the airplane.

That being the case, is it not likely that the parachutist himself will be struck by the tail plane? To be sure he retains the momentum of the machine, and therefore travels horizontally for a breathless moment or two; but he also falls vertically. The opening of the parachute arrests this horizontal and this vertical motion.



This is how the parachute drop looked from the torch of the Statue of Liberty. The Major jumped head-first from the flying-boat piloted by Lieutenant McCulloch. The experiment was conducted by the POPULAR SCIENCE MONTHLY to demonstrate that a parachute of this type will open, even though the flying-machine is less than three hundred feet in the air

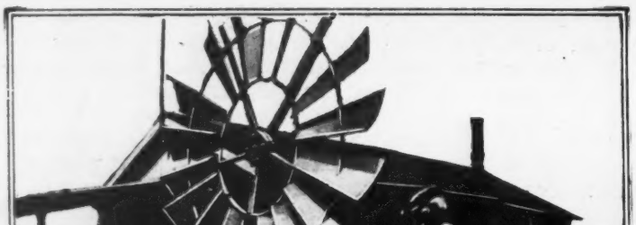
With ordinary parachutes, most of which fail to open for the first three or four hundred feet, the kinetic energy of the aviator may actually amount to more than two tons. Because of the aviator's harness, this weight can be distributed by the body. But what an immense strain is thrown upon the harness itself and upon the life-line leading to the parachute, as well as to the umbrella! Clearly every part must be structurally capable of withstanding extraordinary strains.

Mr. Calthrop has succeeded in lightening the task of the parachute by his positive opening device. The longer the drop before the supporting surface opens, the greater must the strain of necessity be. But the *Guardian Angel* opens within the first one hundred feet. Moreover, there is a rubber shock-absorber, which obviates the necessity of allowing for excessive margins of safety and which makes it possible to save some weight. In all experiments so far held with dummy and human loads, the *Guardian Angel* has invariably opened within one hundred and fifty feet.

Such is my confidence in the *Guardian Angel* parachute that, when the editor of the POPULAR SCIENCE MONTHLY invited me to make a drop from less than three hundred feet, I had no hesitation in placing myself at his disposal. On August 28 last the POPULAR SCIENCE MONTHLY demonstration took place off the Statue of Liberty in New York harbor. The craft used was a Curtiss flying-boat of the Trans-Oceanic Airplane Company; the pilot was Lieutenant McCulloch, who took the NC-3 across the Atlantic Ocean. As a matter of scientific record, motion pictures were made by a man in the torch of Liberty and by another on a boat.

The drop was successfully made at a height of about two hundred and fifty feet. This is the record for a low drop from any type of aircraft. It is beaten only by my own record of a drop of one hundred and fifty-three feet from the Tower Bridge, London, made on November 11, 1917.

How does it feel to drop? The question is put to me over and over again. Jumping off in cold blood is always an ordeal, even to one who has dropped over and over again in a parachute. At the critical moment the question always looms up: Will it work this time? There is a vertiginous drop. And then it seems as if a great, kind giant suddenly but gently grasps me, just as I seem doomed to destruction, and buoys me up so that I float gently to the ground.



At eighty-three he still earns his living by selling sawn driftwood—but the windmill does the sawing

## Why Don't You Let the Wind Saw Your Wood?

FOR years, Louis J. Brotton, of Alameda, Cal., was an engineer; then for years more he earned his living sawing driftwood and selling it. At eighty-three he had grown too feeble to work the saw all day.

Did he give up? Certainly not. He rigged up an eight-foot windmill and made it do the sawing through a belt. A revolving platform is part of the idea. Thus, when the wind turns the windmill, the motion is imparted to the saw.

The windmill is located on the front porch of the small shack in which Mr. Brotton lives. Each day Mr. Brotton goes in his rowboat to near-by beaches and gathers driftwood, which he saws into one-foot lengths and sells for use as fire-wood.

## What It Costs to Stop a Train

WITH a grinding of brakes the train comes to a sudden stop. The conductor explains: "Nothing wrong. Just a signal set against us." Did you ever stop to think that it costs money to stop and start a train?

A series of experiments in order to determine this cost were made in 1905 by J. A. Peabody, a signal engineer on the Chicago and Northwestern, and, although labor and material costs have jumped about a hundred per cent since the time this estimate was made, the figures are still very interesting.

Mr. Peabody took into account the extra wear on tires and brake-shoes, the extra coal required to work the air-pump in replacing expended air, and the increased wear and tear on engine and coaches. As the result of his experiments he estimated that the cost of stopping and starting and accelerating a train ranged from 35 cents for a six-car passenger train at 45 miles an hour, to $1 for an eighty-car freight train of 2,000 tons at thirty-five miles an hour. The extra coal required amounted in a number of instances to some ten per cent of the total coal used.

Where two roads crossed with an average of ten trains a day passing over each road, the loss to both roads from enforced stoppages to let trains pass was found to be $5,800 a year.

## The Bank Messenger and His Wallet Chained Together

GONE! The wallet full of bonds has been stolen! Imagine the feelings of a bank messenger when he finds his pocket empty.

He betrayed himself when he first left the bank by unconsciously patting the prize pocket, and the watchful pickpocket followed this cue when they were caught in a crowd together.

Instead of tucking the wallet out of sight, the new plan is for the messenger to advertise his work by carrying the wallet in his hand. It will be attached to the end of a chain that fastens around his waist. Everyone will know his business, but that very knowledge will be his protection.

That sinking sensation when a bank messenger discovers his wallet is gone

A far better way would be to carry it openly in his hand, chained to his waist

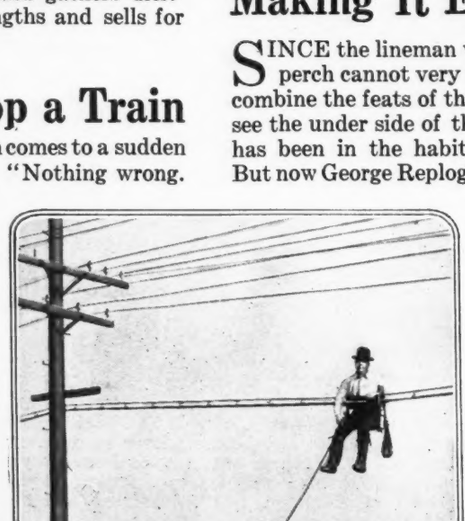
## Making It Easy for the Lineman

SINCE the lineman who inspects electric cables from his airy perch cannot very well get out and get under, he has had to combine the feats of the contortionist and gymnast in order to see the under side of the wires. At least, that is the way he has been in the habit of doing his inspecting until lately. But now George Replogle, of Lafayette, Ind., hurries to the lineman's aid, bringing a mirror with him.

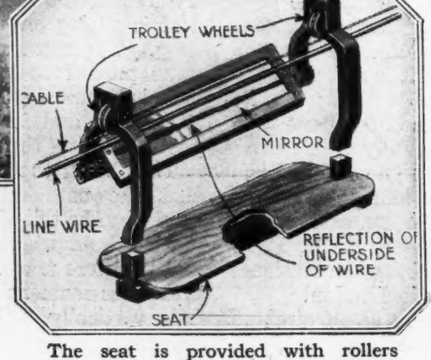
In the lineman's seat invented by Mr. Replogle a mirror is attached to the travelers, and suspended directly below the cable. The seat is both light and compact. The mirror attachment adds little to its weight, and it is not at all in the way when the lineman slings the device over his shoulder preparatory to climbing the pole to begin the day's work.

Once he has the seat safely fixed on the wires, the lineman has only to sit erect and propel it along the line he is inspecting, keeping his eyes on the mirror to watch for defects in those parts of the cable that are not directly visible from above.

The seat is provided with rollers and slides along easily, giving to a once unpleasant job the aspect of something like a joy ride.



As he slides along the cable in a smoothly rolling chair the lineman has only to glance into a mirror to see defects that are invisible from above




The seat is provided with rollers and travels along the wire easily

# A Fireless Cooker for Your Feet

SUPPOSE you were the manager of a large packing-house and had in your employ several hundred employees who had to stand all day on the cold, damp floors of a refrigerating-room. What would you do? Mr. Alonzo Newton Benn, of Chicago, was confronted with this problem, and the result was the invention of a foot-warmer. He is shown herewith wearing one.

It is made in two sections—toe and heel—hinged together. The material used is preferably molded granulated cork with air-spaces therein. Thus the warmth of the foot is retained in the shoe while the coldness without does not penetrate. A flat steel spring attached to the heel portion reaches over to the toe portion and makes the shoe self-closing. When you step into the shoe you press down on the spring, and the heel comes up and closes.

The top of the shoe is finished off with fur or felt; and a stopper is provided that fits into the top when the shoe is not in use, thus keeping the cold air out.

Of course this foot-warmer may be worn in other places besides refrigerators.

This tightly fitting cork shoe, with air-spaces throughout and fur around the top, will surely prevent cold feet

He works in a refrigerating-room, where the cold, damp floors make extra warm shoes necessary

Before the student practises on a patient, he must first drill, clean, fill, and pull the teeth of a dummy jaw

# The Dentist's Dummy

PRACTICE on the dummy—that is the instruction given to the student dentist in the State University of Iowa. He learns to fill, cap, make inlays, and otherwise repair a pair of dummy jaws hinged together and mounted on a stand that may be adjusted to any angle. Thus the dummy jaws may be fixed in the different positions that the jaws of a patient would take.

The teeth are carved out of bone and represent teeth of the average size. The instruments necessary are kept on a shelf near by, and the outfit also includes compressed air, gas, and electricity.

By the time the student is ready to put theory into practice, he will find himself quite skilled in pulling, drilling, and hacking.

# When Is a Bed Not a Bed?

YOU may expect to find a burglar under the bed, but certainly not coffee percolators, toasters, and bureau drawers. Yet these things can be put there, as our illustration below shows.

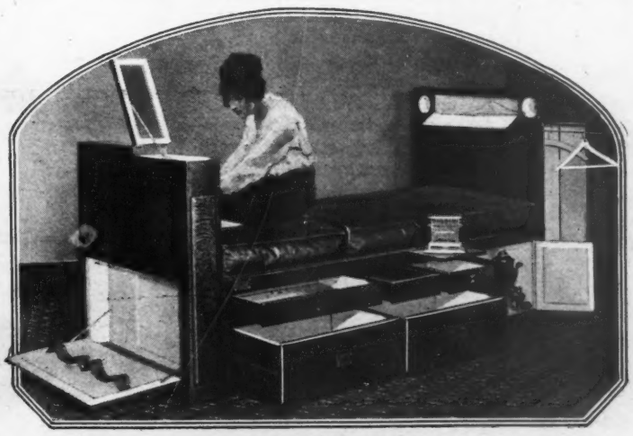
The bed is what is known as a cabinet bed and is used for a multitude of purposes. Besides the drawers, shelves, and cupboards underneath, the head and foot sections of the bed are partitioned off. In the head section there is a clothes closet and two shining electric lights.

The foot section boasts of a mirror and a medicine-chest on top, with a closet for shoes placed most conveniently below.

Alas! there is no icebox, though there seems to be enough space for one in the center of the foot of the bed. But, of course, that wouldn't do. It might freeze the sleeper's toes.

The lady of our illustration has just finished her breakfast; she cleaned out the percolator but she forgot to put away the toaster. Never mind; she will notice the oversight as soon as she turns around.

We are not sure when that will be, for, you see, she has made a beauty parlor out of her bed and has just started working on her nails.



The man who invented this extraordinarily compact cabinet bed certainly did not believe in wasting an inch space

# Whistling for the Boss

THE boss walks up to the department manager's desk. "Is Mr. Harris around?" he asks the office-boy. "Yes, sir, he's around the place somewhere; I'll get him," replies the boy.

He takes up the telephone and asks the operator to get in touch with Mr. Harris. Immediately a horn-blast echoes through the building: *Toot—toot—toot—toot!* It is Mr. Harris' code signal. Shortly afterward the telephone rings and business proceeds in its usual manner.

The telephone will not always reach a man in a noisy factory, and as an executive's business calls him to many different parts of the building in the course of a day, the electric horn has been introduced as a signal to locate such men.

The apparatus is a powerful electric horn, wound for the ordinary voltages, and operated from a semi-automatic switchboard. The operator merely sets the desired code number on a dial and pulls a lever. The mechanism is thereby set in motion, and the apparatus automatically sounds the call on the horns scattered through the building, repeating it three times, and then stopping of its own accord.

## Hattie Gets Her Semi-annual Bath

"THE crowds gathered round to watch, when Hattie was given her semi-annual bath." Be not alarmed; Hattie is an elephant and looks no different when prepared for a bath than she does ordinarily. Her home is in Central Park, New York city, where she is immensely popular.

Her hide is scrubbed vigorously, washed off, and sponged. Then, when it has dried, great jars of oil are rubbed into it. This keeps it from cracking. Two of these massages each year are enough to keep Hattie in good condition. Hattie evidently enjoys them, for she submits very passively.

## Cave-Man Stuff in California

NO, this is not a movie still of "Stranded on a Desert Island," but a photograph of William Pester in his customary suit sitting outside of his town house at Palm Canyon, Cal. He has gone "back to nature." He lets his hair and beard grow to suit themselves, wears a cheap and simple apron, and forages for his food.

Spasmodically he makes trips to the large cities and tries to convert the inhabitants to his way of living—with but little success.

When on these trips, he discards his one-piece costume and wears an old soft shirt, trousers, and sandals.

## He Rides with His Work

ONCE upon a time the "scissors man" used to tramp wearily down the street, his heavy grinding wheel slung over his shoulder; or else he rode in a little cart behind an old horse.

It remained for a Frenchman to rise to still greater heights. We present him here enthroned upon his auto-grinder. Two automobile wheels suffice to carry his sharpening kit, the grinder and the small gasoline engine that provides motive and grinding power. We are told by our Paris correspondent that he has added two hundred per cent to his earnings.

## When Canal Meets River

IF you were building a canal that had to cut across a river, what would you do? Let the canal run into the river and station a traffic policeman at the watery cross-roads?

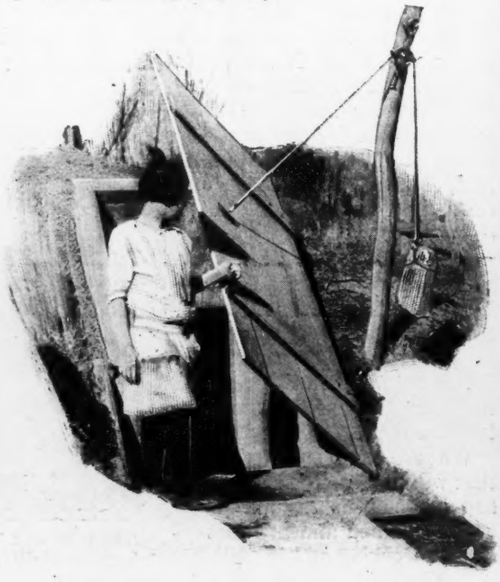
The people of Chaumont, France, asked themselves this same question when a canal they were building reached the banks of the Marne river. Their answer was the attractive bridge which is shown in the center of the page.

Though it seems like a strange and original idea to build a bridge over water to carry more water, yet it is really very important to keep the two waters apart because of the tides and flood seasons to which the river is subjected.

There are over three thousand miles of canals in France and they are used chiefly for lugging heavy merchandise such as coal and building materials. The canals are owned by the state and are nearly all free from toll. The larger canals have a depth of six feet or more, with locks one hundred and twenty-six feet long and seventeen feet wide.

## Conquering a Stubborn Door

IN some parts of the South and West the prosaic cellar is replaced by a romantic cave in a hillside. The old-style, half-recumbent cave door makes it unnecessary to construct a vestibule to the cave, but its weight must be lifted every time the door is opened. This objection can be removed by installing a simple automatic lift consisting of a weight sufficient to balance that of the door and attached to the door by a strap or small rope passing through a pulley.



## Poor Fido!—Or Perhaps He's Diddums

HE is wearing the latest in Parisian hair-cuts,—we have it on the word of our Paris correspondent,—but he doesn't look happy over the distinction. Doubtless his name is Toto and he is a gay dog at heart, but saddened by the names that ordinary street pups hurl at him when they meet him.

Then again, perhaps he is a descendant of some seventeenth-century cavalier dog who aped the ways of his master and handed down the fashion of wearing the hair long, with a love-lock tied with a gayly colored ribbon at the end.

We imagine he has heard about those dainty little ribbons tying up his forelock until he is sick of the whole tonsorial business and would almost change lots with an alley cat. But perhaps we are wrong.

Maybe he's called Diddums,—Diddums, as is a lap-dog we know,—and enjoys his degradation, not knowing what it is to be a regular dog.

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## When It's Summer in Japan

HEAD, feet, and a fan are all you see on the surface of the water in the picture at the left. Mr. Keishimoto, of Japan, is floating and at the same time fanning himself—holding the fan between his toes.

But why should he fan himself when he is almost entirely submerged in clear, cold water? He is demonstrating that, in spite of his fourscore years and ten, he still is quite agile. If you doubt the skill necessary for performing this feat, try it yourself—but our advice is to choose a day when the water is calm and a spot where you are sure that no one will be watching you.

In the first place, it is very hard to keep your head erect above the water unless you are swimming the breast stroke or treading water. Mr. Keishimoto is doing neither; he is floating on his back. But at the same time he is wiggling his toes—which everybody knows you are not supposed to do when you float.

## Now for Half-Sized Telephone-Booths

IF you suffocate and are most uncomfortable in an ordinary telephone-booth, how would you feel if they cut it in half? Twice as bad, say some; it couldn't be worse no matter what they did, say others. Well, anyway, the picture below shows a half-sized booth, so you can judge for yourself.

The object, of course, is to save space in already crowded stores and other places where it is customary to install telephone-booths for the convenience of the public. The booth is an equal-sided right triangle, and the telephone is located in the middle of the hypothenuse. Thus, you see, you stand in line with the altitude, and really have almost as much space to move in as you had in the old square booth.

But this is a tale of booths, and not of squares and triangles.

## How'd You Like to Be a Movie Star?

LIKE to be a movie star, wouldn't you? Nothing to do but dress up, smoke cigarettes, and register emotions. Ah, but suppose you were told some day to jump from the top of a fast moving train and catch hold of a few dangling ropes? That alters the case.

Tom Mix, a well known star, was given that order, and he filled it, as our illustration shows. He wasn't sure that the ropes would hold, or that he would catch them; but he went after them as per orders.

The ropes are called "telltales," and are stationed on both sides of low bridges and tunnels to warn men walking on top of the trains. They are just long enough to give a man a sound crack on the head.

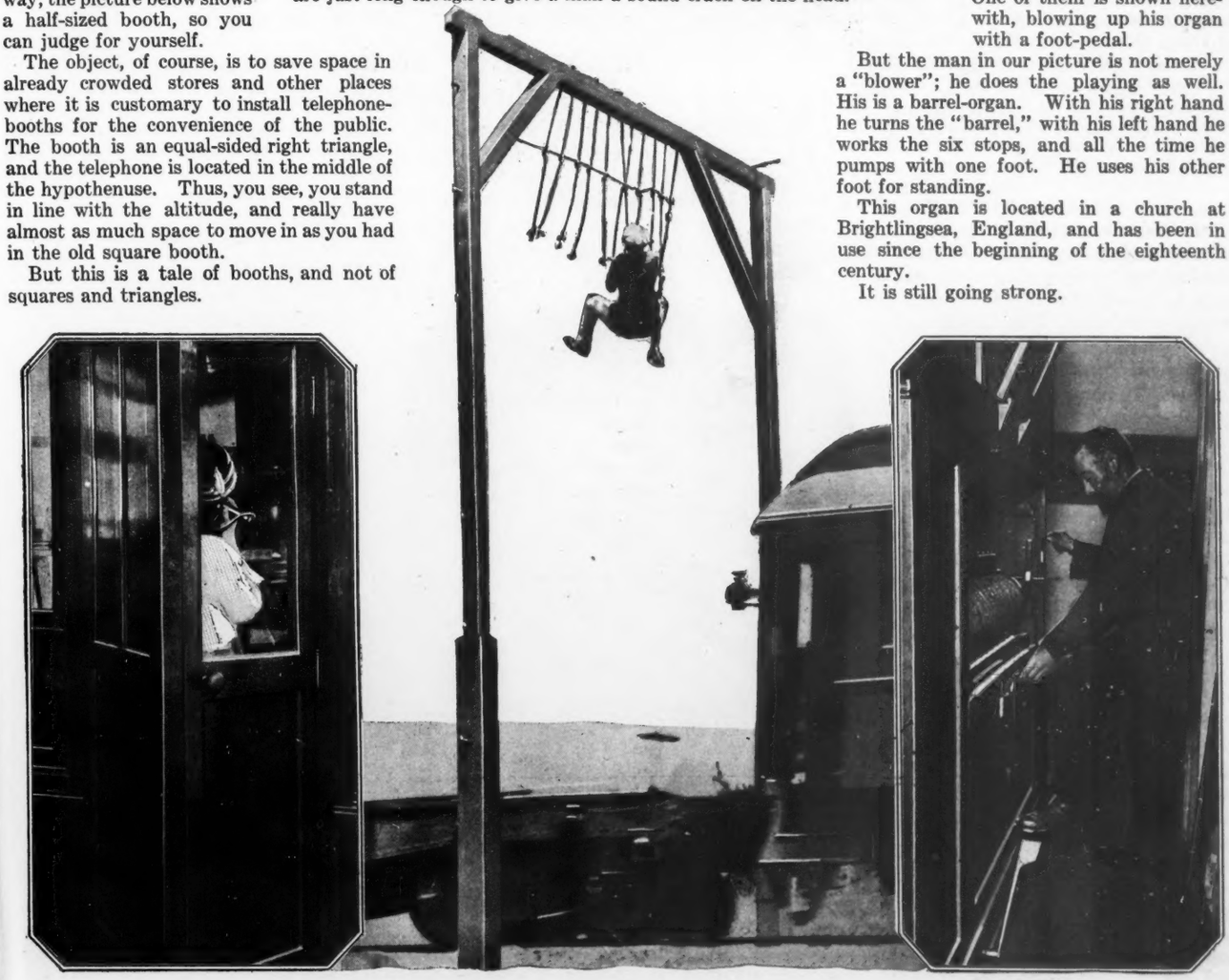
## Is It the Oldest Barrel-Organ?

AS you sit in a small country church, silent except for the birds outside, you suddenly hear a great creaking and wheezing. Ah! The organ is being tuned—or rather blown up. And the man who does the blowing? One of them is shown herewith, blowing up his organ with a foot-pedal.

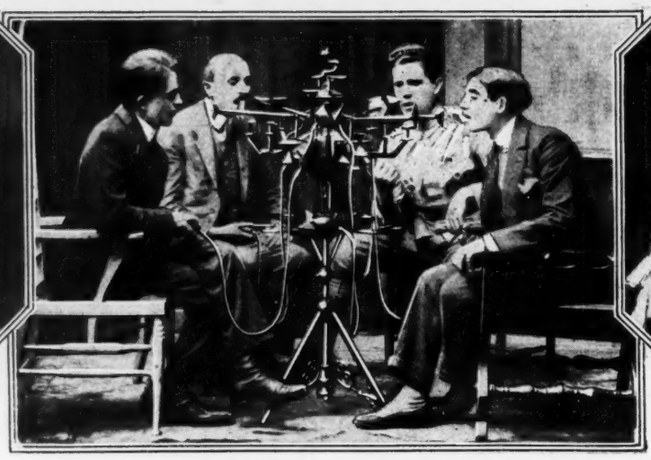
But the man in our picture is not merely a "blower"; he does the playing as well. His is a barrel-organ. With his right hand he turns the "barrel," with his left hand he works the six stops, and all the time he pumps with one foot. He uses his other foot for standing.

This organ is located in a church at Brightlingsea, England, and has been in use since the beginning of the eighteenth century.

It is still going strong.



For directing the medicated vapor to the head of the larynx for the treatment of bronchial affections a pointed nozzle is used



Here a party of four patients is using the family vaporizer, inhaling the medicated vapors through different nozzles

Travelers may continue their inhalation treatment while touring if they provide themselves with one of these pocket vaporizers

# Gassing Your Breathing Apparatus

IN cases of disease of the lungs, the bronchial tubes, the larynx, and the nasal passages, it is often desirable to apply medicines directly to the diseased mucous membranes. The nasal passages and the upper parts of the larynx are comparatively easily accessible for local treatment by douches or spraying; but the lower parts of the larynx, the bronchial tubes, and the lungs cannot thus be reached. It is obvious that neither solids nor liquids can be applied to the mucous membranes of these deep-seated organs. If any medicament is to be applied to them, it must be in the form of gas or vapor inhaled by the patient.

Numerous apparatuses have been invented for vaporizing medicinal preparations for inhalation purposes. A French inventor has designed a number of vaporizers suited for various conditions and based on the same principle. The substance to be vaporized, be it a medicament, a disinfectant, or a perfume, is placed in a container and heated by an alcohol lamp, a resistance coil, or some other source of heat. The vapor rises in a tube, and meets a blast of air from a blower or a pneumatic bulb operated by hand. The vapor becomes intimately mixed with the air, and is expelled through an opening of suitable form, either as a fine jet or in the form of a cloud of vapor.

The inventor has built vaporizers in a variety of styles and sizes, from the traveling model which, when closed up, is barely larger than a cigarette-case and may be carried in the pocket without inconvenience, to the large apparatus supported by a stand and making it possible to treat several patients at the same time.

Some of the models make it possible to combine the vapors of several medicaments and to inject their intimate mixture through a single nozzle, while others automatically measure the doses of the vaporized medicament to be administered. The apparatuses for vaporizing disinfectants and perfumes are based on the same principle, but are more simple.

In some of the large models the vapor may be intermittently expelled in the form of rings or clouds by the use of pneumatic bulbs pressed by the hand of the patient. Some of the smaller models of vaporizers for perfumes or deodorizers are cleverly camouflaged in the guise of vases, statuettes, or other objects of artistic design.

The accompanying pictures, illustrating three different models of the new apparatus, show clearly the adaptability of the vaporizer. By the use of different nozzles the apparatus may quickly be suited to the requirements of each individual case.

## In the Cellar of this Brewery Now the Mushrooms Grow

ALAS, poor cellar! We knew it once when it was full of tubs—copper ones for making beer. Now it is used for growing mushrooms! That is how the owners of one brewery decided to make use of their idle building.

Mushroom culture is a very profitable business. The plants are easily and cheaply raised, and the mushrooms are sold at a high price. The beds must be made in dark places where there are no draughts, such as cellars and tunnels. In the cellar of the brewery shown below the beds are arranged in rows with narrow paths between them. Each row is about twenty-two inches high and wide. The beds are covered with fertilizer and then sprinkled with sand. A short time after the spawn is planted, the mushrooms break through.

In France many thousands of dollars are made each year by raising mushrooms in cellars.

A single faint electric light guides him as he gathers the full-grown mushrooms in the cellar. Mushrooms grow in damp places

What goes on behind the darkened windows of this brewery now? Mushroom culture. The beds are where the vats used to be

# The Movies Are at Your Back Door

Knockdown towers are used in taking industrial films for educational and publicity purposes. Dr. Francis Holley uses the pictures in free exhibitions, his object being to make people realize how wonderful is the gift of sight. Dr. Holley was blind for eighteen years

THE Bureau of Commercial Economics, of Washington, D. C., has launched an educational campaign in which moving pictures are to be used as textbooks. At the head of the movement is Dr. Francis Holley, who was blind for eighteen years. The free display of motion pictures is his method of keeping his vow that if he ever regained his sight he would devote the remainder of his life to teaching the rest of the world how wonderful a gift sight is.

The Bureau is supported by voluntary subscription, endowment, and annuities, and already has a library of 20,000,000 feet of film to draw upon. The films illustrate a great variety of subjects, but place special emphasis on depicting the manufacture of various articles of commerce from the raw material to the finished product.

Specially constructed motor-trucks are employed by the Bureau in this educational campaign. Each truck contains its own electric light plant, and carries a standard projection machine at the rear end, and a collapsible steel frame which, when set up, will support a projection screen twenty feet wide and thirty-six feet high. The generator on the truck supplies the necessary current for a number of flood lights placed in the sides of the car body. These trucks have carried instructive films to the remotest districts, and exhibited them free.

During the war the service of the Bureau was placed at the disposal of the Government and contributed materially to the success of the Liberty Loan campaigns and the various drives for charitable or patriotic purposes.

Motion pictures of industrial processes are of particular value just now, when the Allied nations are making tremendous efforts to find markets for the products of their factories, mines, and farms.

Trucks like this carry and exhibit Dr. Holley's films to millions of people all over the world

# Built to Carry Passengers through the Air

"WHY build giant engines if several smaller ones will do?"

This question is often asked of aeronautical engineers when they express the opinion that the very large and powerful engine is one of the necessary requirements for the great passenger machines of the future.

There are many points in favor of the gigantic motor. First of all comes the all-important question of weight.

Two small engines of 300 horsepower will weigh more than one large motor of 600 horsepower. The small engines must have two sets of crankcases, magnetos, and cylinders, while the large machine has only one set—heavier, to be sure, than each of the smaller sets, but lighter than the two together.

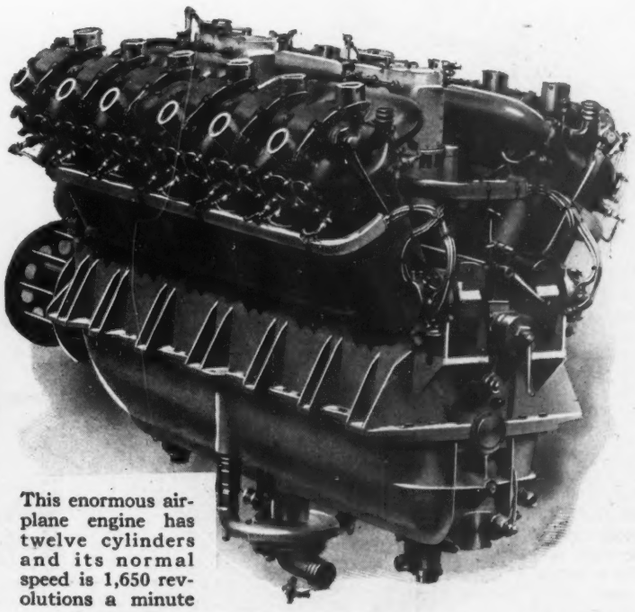
Quite as important is the propeller efficiency. The losses in one large propeller are less than the combined losses in two smaller propellers.

Isn't it clear, therefore, that a well designed large engine means a big step toward the giant commercial machine of the future?

Knowing this, an Italian firm of automobile engineers recently designed the largest aviation engine of today. The engine has twelve cylinders arranged in V-fashion. The bore is 6.8 inches, the stroke 8.4 inches, while the normal speed amounts to 1,650 revolutions a minute. At this speed the engine develops 685 horsepower, but if necessary it can be run at 1,700 revolutions, when it will give 750, its maximum horsepower. Some advance on the anemic 35-horsepower engines of only ten years ago, is it not?

The weight of this engine is not high considering its power, for the complete motor weighs only three-quarters of a ton. A large single-engined biplane has been built specially for this big motor.

Last summer this machine flew from Paris to London, a distance of 225 miles, in just over a hundred minutes. A few days before performing the feat, the airplane had traveled from Turin to Rome and from Rome to Paris at an average speed of 163 miles an hour, thus breaking all records for this journey.



This enormous airplane engine has twelve cylinders and its normal speed is 1,650 revolutions a minute

# Nothing Seems to Cure It: I'm

## The modern patient's life has

She is neither telephoning nor seeking haven in a costly bath-house. A moment after this picture was taken she shut the door on herself and her irritated throat. She turned on the steam, let the device at the side flavor and permeate the little room with menthol, and long before the picture was developed she had developed perfect health

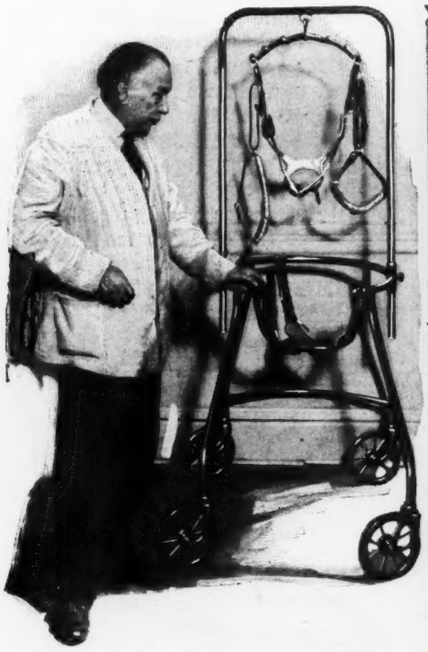
In a gymnasium suit this dignified man could obtain a maximum of embarrassment and a minimum of exercise. So, taking a position twenty feet from his own fireside, he takes the exercise for chest and shoulders that his physician has suggested. He pulls up the springs and they pull down the fatty tissue

The gas gong has not been rung, nor is the young woman drawing treasure from a near-by florist's shop. She can't sleep. She's only a young miss, and he told her when he came back from war he'd probably — Well he's due back next Monday, and she can't sleep. This device removes the excess moisture from the lungs without pain or inconvenience, producing a soothing effect that terminates in sleep

This looks too comfortable to be scientific. The patient is undergoing hot and cold hosing to stimulate tired nerves, and, as any fire-horse can tell you, there's nothing like it. The control table automatically regulates the temperature of the water and the health of the patient, and the accuracy of the operator increases with every treatment. Would you rather give it or get it?

# Taking Something for It All the Time

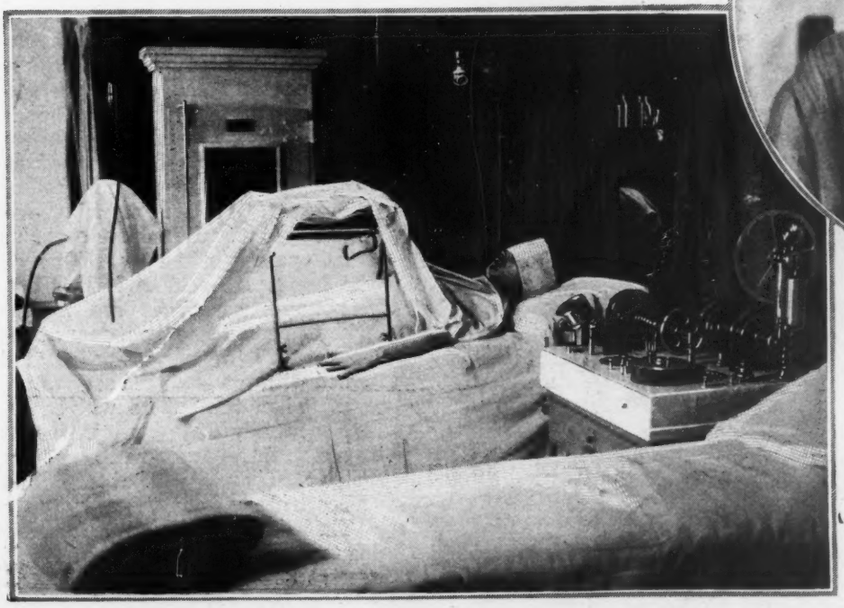
## become just one machine after another



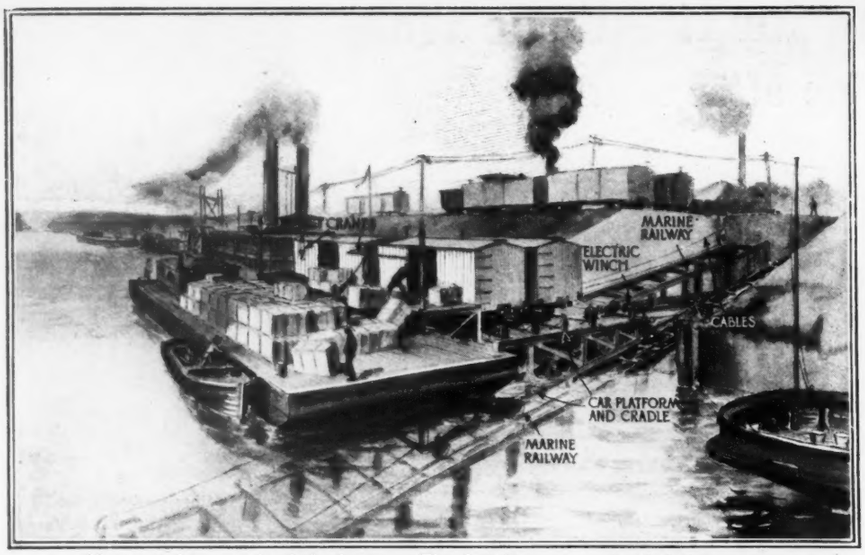
This device is not sent F. O. B. Detroit, but the cost of upkeep is about the same and it will go anywhere. Sufferers from paralysis or long-continued illness enjoy this runabout in a twinkling. It supports the arms, head, and legs, and if necessary the neck, and is so readily moved that the first paragraph of a Bolshevist's speech would blow it a block

This young woman is not gratifying the almost universal desire for a moment in the spotlight. The big lamp she is facing gives off ultra-violet rays identical with those of the sun, and she is busy getting rid of her bronchitis or threatened tuberculosis. She wears goggles because, be it in a studio or on the road, a glaring light is not fit to look at

A slight stomach-ache may become the center of one's whole world. Below is a little cabinet containing four radiant lamps to throw heat and curative rays at the very point where the pain is unbearable. According to the inventor, the results are equivalent to those that might be obtained by the application of two thousand hot-water bags, one ton of plasters, and a sheaf of old-time prescriptions



This is no effort on the part of the subject to toss a mean look at the world through a lorgnette. To be perfectly frank, the young woman has undergone a facial massage and shampoo at the hairdresser's and is now removing the tired lines from under her pretty eyes (note unencumbered eye) with high-frequency current. She got up at dawn and is getting ready for the Midnight Frolic, to which she has a perfectly valid invitation




No roustabouts unload the barge. The freight-cars are hauled down on a marine railway to the level of the barge-deck: the rest you can imagine

# Taking the Freight-Car to the Steamer

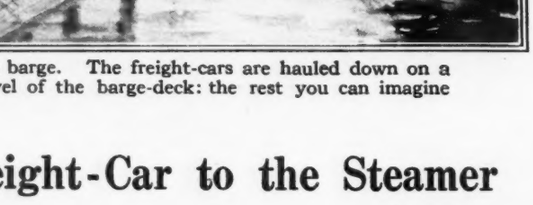
IN order to do away with the roustabouts who are a familiar sight along our Southern rivers, Gustave A. Hansen has invented a loading and unloading system. He believes that his invention will do away entirely with tedious hand trucking.

A trainload of machinery arrives at Smithtown. There is no wharf. Five carloads are to be transferred from the railway tracks on shore to the steamer. Ordinarily this means hours, or days, of hard manual labor. How can the task be accomplished without handling in the usual way? If you will study the illustration shown at the top of this page you will see how Mr. Hansen is planning to do it.

A marine railway runs from the tracks on shore down into the river. What Hansen calls a cradle moves on the marine railway. Two of the freight-cars are backed upon the cradle on shore. Then the cradle is hauled down the marine railway with the aid of a cable passing around an electric switch to the steamer.

It's simple enough now to transfer the freight from the cars to the steamer; for the floor of the car and the deck of the steamer are flush, the freight passing over an intermediate platform on the cradle, which must be held at exactly the right level.

All this maneuvering, of course, will require the most careful and skilful handling of the steamer. The vessel must be held in exactly the correct position for keeping the cars at the right level. Still, Hansen thinks that this will be a very simple matter, because the cradle with the car will help to push the steamer out just the right distance.

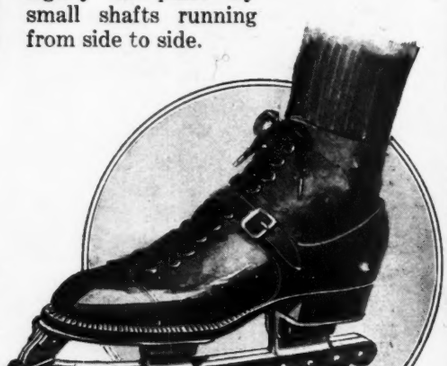



How the marine railway pulls the freight-cars down to the barge and up again

# You Can Ice-Skate on the Sidewalk Now

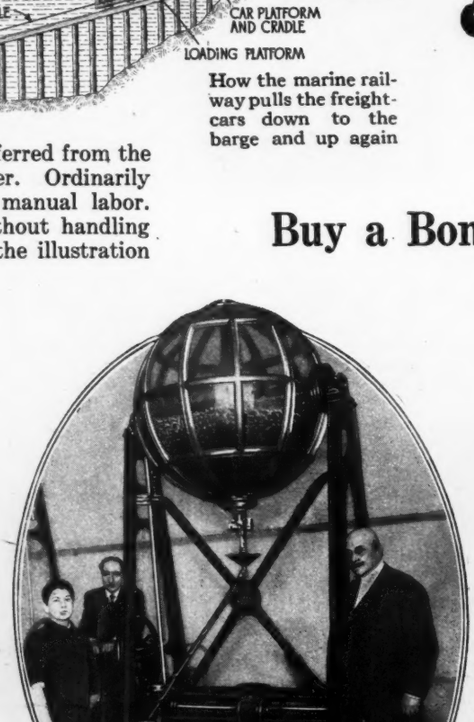
ALL the joys of ice-skating—without any ice—are provided for in a skate invented by Harry Paulsen, of New York. It has rollers all along the bottom and a hard rubber knob clamped to the point. The knob is used for pirouetting, and the rollers allow a flexibility of motion that is not possible with the ordinary roller-skate. On these skates you can make a figure eight, spell your name, waltz, or do any other icy tricks.

At first glance Mr. Paulsen's skate looks like the ordinary ice-skate, for the rollers are almost concealed between the side plates. They are held rigidly in place by small shafts running from side to side.



The iceless ice-skate depends on rollers instead of on ice for its quality of slipperiness

# Buy a Bond and Win a Bonus



Each cartridge in the glass sphere contains a number corresponding to a French bond; the owners of lucky-number bonds receive bonuses varying from small to large sums

THE glass sphere in the picture, containing what look like cartridges, is not some new weapon of war. It is a lottery jar, and was made for a French bank, the Crédit Foncier. A lottery jar four times the size of this one, to contain millions of cartridges, is being built for the city of Paris, and $60,000,000 will be given out in bonuses to holders of lucky-number French victory bonds.

Each cartridge will contain a slip of paper carrying the number of one of the victory bonds to be floated by the city of Paris. The cartridges will be dropped into the sphere through a small opening in the top. When all the bonds are sold and their corresponding cartridges are in the sphere, a small steel trap-door at the opening will be closed, locked, and sealed with the great red seals of the city. Then the sphere will be revolved rapidly, and when it is brought to a stop the opening will be at the bottom. The seals will be broken, and the cartridges shot out, one by one.

The holder of the bond corresponding to the first cartridge shot out will receive $250,000.

# Cutting Down the Cost of Living

This is one reason why the cost of living is high

**Twenty-six miles a day is the average journey of a freight-car. It's the present cost of transportation that helps to keep the "high" in the high cost of living. Herewith we present an Englishman's solution of the distribution problem**

WHAT shall we do to reduce the cost of living? There are two solutions, economists tell us. Produce more—that is the first solution. Distribute more efficiently—that is the second solution. Increased production means the speeding up of existing machinery and the invention of new and better machinery. But more efficient distribution? The more one considers that tremendous problem, the more one is convinced that nothing short of a complete transformation in the methods of handling goods at our terminals can meet the situation.

Something must be radically wrong if it costs less to send a bale of goods from Havana to Boston, 1,300 miles, than to transfer it from one pier in Boston harbor to another; if it costs as much to deliver a machine-tool from one of New York's great terminals to the hold of a ship as it does to transport it by rail from Chicago to that New York freight terminal; if a bale of cotton can be shipped by water from Savannah to New York at less cost than for raising it from the hold of the vessel and transferring it to a Brooklyn warehouse.

### *Average Day's Run of a Freight-Car*

The worst of it is that when terminals are so poorly equipped as to make it impossible to load, unload, and distribute quickly, the arteries of supply suffer in turn. We boast of our long hauls. We never speak of the inordinate waste of time entailed by poor terminal facilities. The average daily mileage of two thousand freight-cars on one hundred forty-four railroads, according to recent records, is—what, do you suppose? Twenty-six—just twenty-six! And these twenty-six miles were covered at the breakneck speed of two and one half hours! These 2,000 freight-cars are only ten per cent efficient. And we think that we have progressed since we abolished the stage-coach!

It costs $3,000 a day to hold an ocean freighter in port; $1,000 a day to hold a coastwise or tramp steamer. Since New York, Boston, and other American ports supply the country and distribute the country's products, imagine what must be the cost to the people of the United Sates in the delays incurred in moving 600,000,000 tons across the marine freight terminals!

Now, it must not be supposed that our government, state, and city authorities have been blind to conditions that were antiquated fully fifty years ago. Within the memory of living men, at least a dozen schemes have been proposed to better our distributing machinery. It is hard to change a complicated and more or less standardized system. New York was probably the last large American city to change from horse-cars to electric traction, from gas-lamps to incandescent arc lights. The change was staggeringly expensive, but it had to be made. And so it is with improving our methods of distribution, not merely in our large ports, but wherever there is an important freight terminal. Tens of millions, possibly hundreds of millions, must be spent; but, until they are spent, we must expect to pay twenty-five per cent, and possibly more, for the necessities of life.

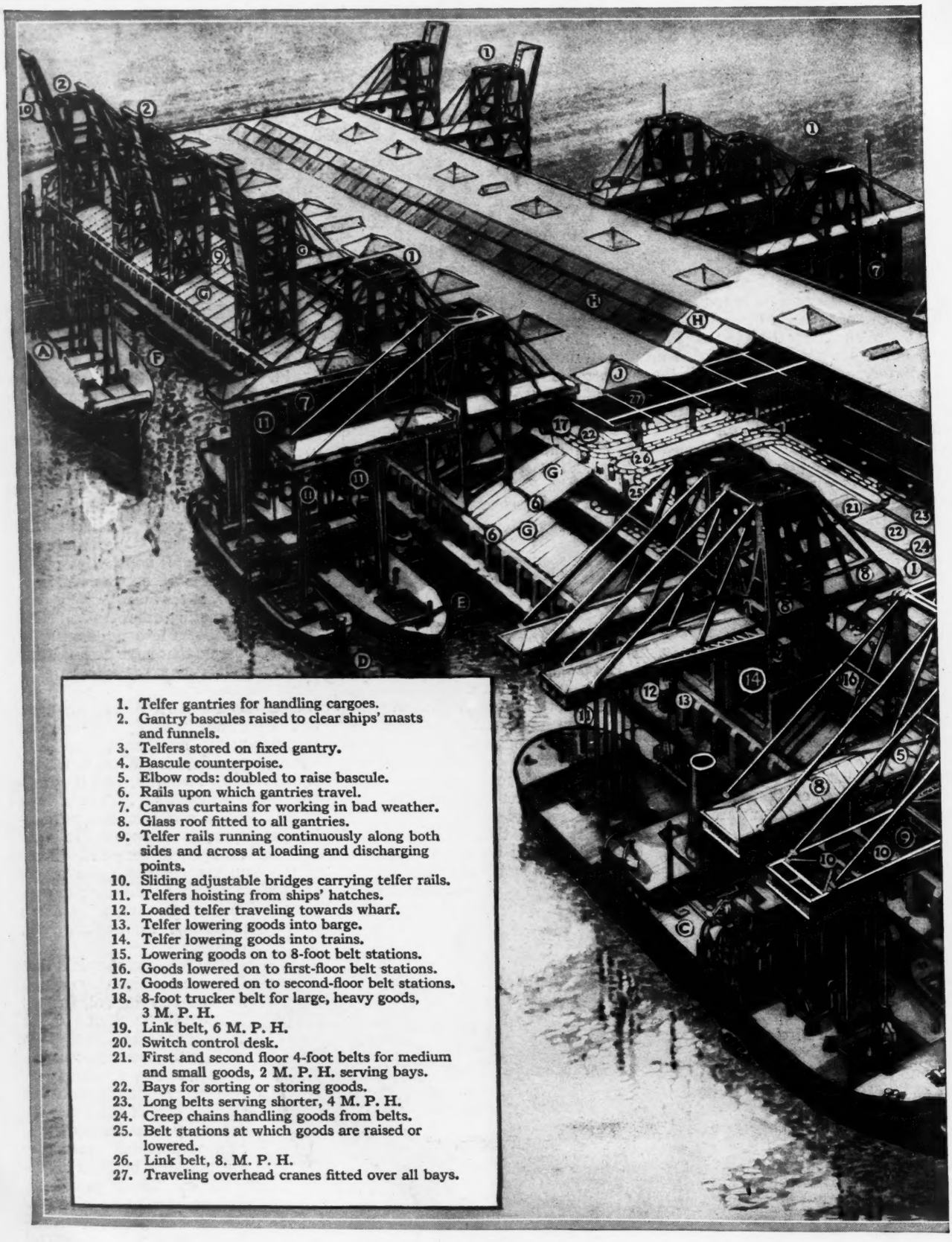
Admitting all this, what system of distribution shall we adopt? Most of the machinery that is advocated for our ports and cities is of local benefit only. The distributing system of the country as a whole must be considered. The system that is adopted must provide not simply means for quickly loading and discharging a cargo from a ship; it must reduce the time of transportation to inland cities and the cost of commodities to the farmers of Nebraska.

### *The High Cost of Loading*

Under the present system, when a cargo is unloaded, it is transferred not immediately to freight-cars, but to warehouses, a process attended with much man-handling. Warehouse accommodations are hopelessly inadequate. Freight is left on wharves, to be handled later, in the meantime congesting and dislocating other traffic. Ultimately it dribbles into warehouses or into freight-cars that have been waiting empty *elsewhere* for days or weeks. Thus thousands of tons of perishable freight is annually destroyed; time and labor are wasted; deliveries to manufacturers, merchants, and consumers are delayed. When a freight train is at last made up, and it speeds on its way to Chicago, St. Louis, New Orleans, one of a score of many American cities, what happens? It runs into an antiquated terminal. Some of the cars are detached; the others are broken up to be dispatched over several different railways, after much switching, sidetracking, and coupling.

Teamsters and motor-truck drivers waste from two to three hours by merely standing in line at terminals. When the congestion is at its worst in New York, a driver unhitches his horses, leads them off to the stable for the night, and returns the next day

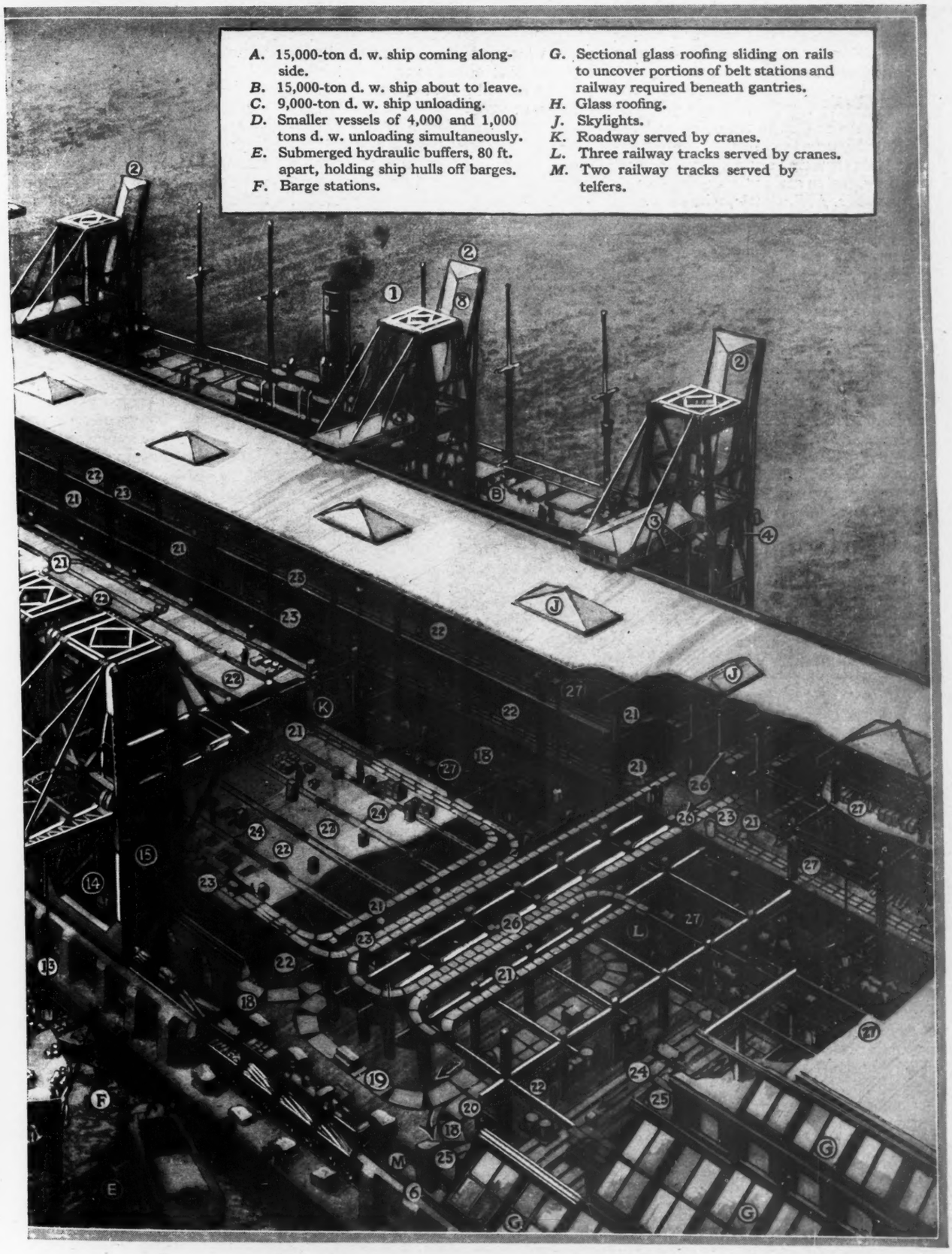
The railways complain that they are not receiving enough for the carrying of freight. The truth is that freight charges are exorbitantly high because they cover not merely the actual cost of transportation and a legitimate profit, but also the cost of the losses incurred by an outrageous system, perpetuated because it was nobody's business to improve it. The high freight charges have to be added to the cost of goods, with the result that manufacturers and retailers raise their prices to the consumer, who, in the end, foots the bill. Yet these very freight charges react on the railway companies themselves. They too must pay for material—pay, moreover, their



1. Telfer gantries for handling cargoes.
2. Gantry bascules raised to clear ships' masts and funnels.
3. Telfers stored on fixed gantry.
4. Bascule counterpoise.
5. Elbow rods: doubled to raise bascule.
6. Rails upon which gantries travel.
7. Canvas curtains for working in bad weather.
8. Glass roof fitted to all gantries.
9. Telfer rails running continuously along both sides and across at loading and discharging points.
10. Sliding adjustable bridges carrying telfer rails.
11. Telfers hoisting from ships' hatches.
12. Loaded telfer traveling towards wharf.
13. Telfer lowering goods into barge.
14. Telfer lowering goods into trains.
15. Lowering goods on to 8-foot belt stations.
16. Goods lowered on to first-floor belt stations.
17. Goods lowered on to second-floor belt stations.
18. 8-foot trucker belt for large, heavy goods, 3 M. P. H.
19. Link belt, 6 M. P. H.
20. Switch control desk.
21. First and second floor 4-foot belts for medium and small goods, 2 M. P. H. serving bays.
22. Bays for sorting or storing goods.
23. Long belts serving shorter, 4 M. P. H.
24. Creep chains handling goods from belts.
25. Belt stations at which goods are raised or lowered.
26. Link belt, 8. M. P. H.
27. Traveling overhead cranes fitted over all bays.

# How A. S. Gattie, an English engineer, would reduce the high cost

It costs three thousand dollars a day to hold an ocean freighter in port to load or unload a cargo, and one thousand dollars a day to hold a coastwise or tramp steamer. We, the consumers, pay the bills in the end, and it's a big bill when you consider what are the delays incurred in moving six hundred million tons across the marine freight terminals of our ports. What is the solution of the problem? An English engineer, A. S. Gattie, offers the Gattie


A. 15,000-ton d. w. ship coming alongside.
B. 15,000-ton d. w. ship about to leave.
C. 9,000-ton d. w. ship unloading.
D. Smaller vessels of 4,000 and 1,000 tons d. w. unloading simultaneously.
E. Submerged hydraulic buffers, 80 ft. apart, holding ship hulls off barges.
F. Barge stations.
G. Sectional glass roofing sliding on rails to uncover portions of belt stations and railway required beneath gantries.
H. Glass roofing.
J. Skylights.
K. Roadway served by cranes.
L. Three railway tracks served by cranes.
M. Two railway tracks served by telfers.

## of living by loading and unloading ships with automatic machinery

system illustrated by the picture above: huge self-propelling cranes, railway tracks on which freight trains run, a system of automatic conveyers. A vessel berths; an empty freight train draws alongside; a crane handling twelve tons a minute runs into position opposite one of the hatches. The cargo is hoisted and deposited into freight-cars or lighters, or upon belt conveyers, by which it is delivered to any desired bay in a storage warehouse

share of the increase which their own charges help to raise. The evil grows progressively, increasing like a rolling snowball, while the people wonder why the cost of living is ever increasing.

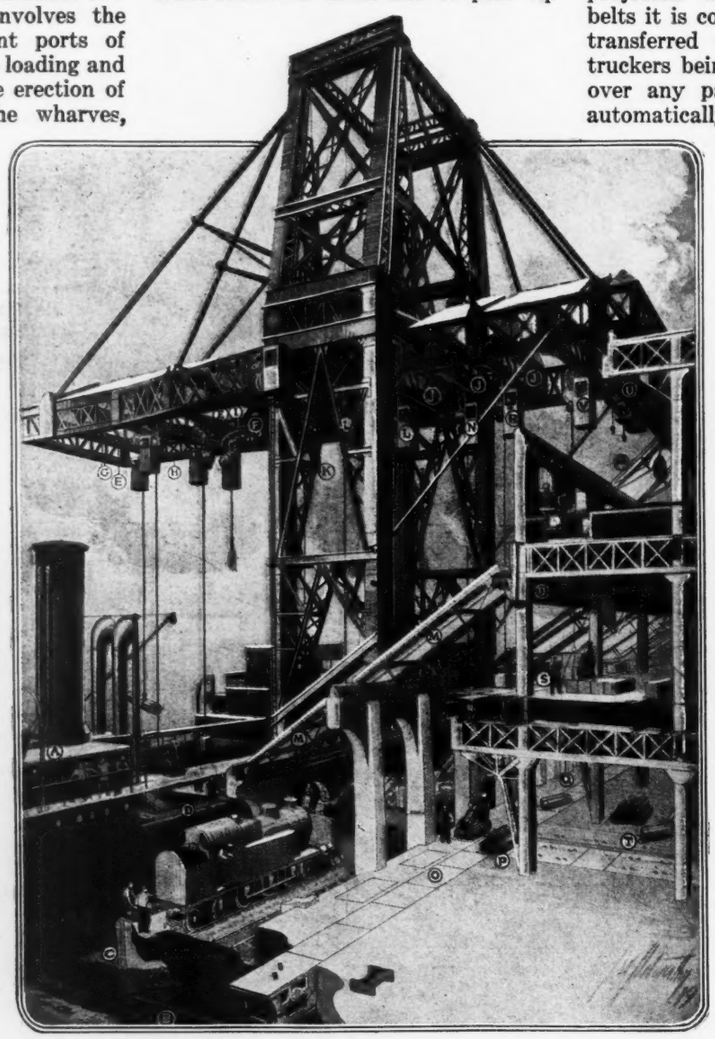
### *How Gattie Would Solve the Problem*

One of the first to recognize and energetically urge the necessity for reforming this system on a drastic and comprehensive scale was an English engineer, Mr. A. S. Gattie, who for many years has been developing the plan pictured in the accompanying illustrations. Mr. Gattie's scheme, for convenience, may be considered under two headings. The first (*a*) involves the provision at all important ports of adequate apparatus for the loading and discharge of ships, and the erection of suitable buildings on the wharves, equipped with mechanical and automatic devices for the quick sorting, storing, and dispatch of freight. The second (*b*) involves the construction at every big railway center of a central freight clearing-house which is to take the place of the existing independent railway freight-yards, the building being equipped throughout with mechanical hoists and conveyers, by which freight may be rapidly transferred, sorted, and dispatched, connected by underground lines with all the principal railways and communicating by roadways with the consignee. Standardized containers (cases, crates, or slings) are to be used, in which the cargo or freight is to be held, so that it can be bodily transferred in bulk to and from freight-cars and motor-trucks. A systematic organization for the rapid collection and delivery of goods by motor-trucks, so as to relieve street traffic congestion, is a subsidiary feature of the clearing-house.

Consider first the loading and unloading equipment which Mr. Gattie advocates for a port.

Along the edge of a wharf or quay are two parallel walls, consisting of a series of arches, on top of which rails are laid upon which huge self-propelling gantry cranes travel. Between the walls are two railway tracks on which freight trains are drawn alongside berthed vessels. On the inner side of the inner wall a building of three floors is shown. From the second floor of this building to the wall, a lean-to roof, which travels longitudinally in sections, is arranged so that any section may be moved out of the way when a crane is at work.

On the ground floor a system of continuous "trucker" belts is provided to travel longitudinally, and at suitable intervals cross traveling belts are provided. Similar travelers are provided on the upper floors. The gantry cranes are fitted with a number of "telfers," or hoists, arranged to travel along the crane cantilever arms and to pick up goods from the holds of vessels and deliver them on shore. Each crane would handle twelve tons of cargo a minute.



A. Typical steamer with 9,000 tons of mixed cargo
B. Hydraulic buffer against ship's side
C. Barge lying between wharf and ship
D. Lower hatchway half opened, allowing both decks to be unloaded simultaneously
E. Traveling bridges suspend telfers over hatches
F. Traveling bridge rail
G. Telfer rail
H. Point closed to lead telfer on bridge
I. Point opened by swinging upward on a pivot built on the bridge
J. Fixed telfer bridges
K. Telfer lowering into barge
L. Telfers loading trains
M. Sliding roof sections drawn from under gantry
N. Telfer unloading large belt stations
O. Eight-foot trucker belt
P. Alleyway removing goods from belt
Q. Rail for overhead crane
R. Telfer loading first-floor belt station
S. Case transferring from long to short belt
T. Alleyway discharging case
U. Traveling crane
V. Telfer loading second-floor belt station
W. Spare telfers

To unload or load a ship, Mr. Gattie has invented a new type of electric crane. By bringing one of these cranes into operation over each of a ship's hatches, a large number of squads of men may be employed in loading the almost continuous series of powerful hoists each crane brings into action. The speed is limited to the quantity of goods that the men can attach to the hooks or grabs. The cranes are capable of carrying twelve tons per minute or less, the time being determined by the nature of the cargo and the labor available. It is said that nine of these cranes working over nine hatches would be capable of carrying one hundred and eight tons a minute

### *How the Plan Works*

The *modus operandi* is as follows: A vessel is berthed, an empty freight train is drawn up alongside, and a gantry crane runs into position opposite one of the holds. Cargo is hoisted up by the telfers, and deposited either directly into freight-cars or barges or on to a stationary platform alongside the trucker belts, on to which it is mechanically projected when required. By these belts it is conveyed and automatically transferred to the cross belts, the truckers being so arranged that goods over any particular trucker may be automatically delivered on to any cross belts, by which in turn the packages may be conveyed to any bay of the warehouse for storage, or may be delivered right away into freight-cars on the other side of the building.

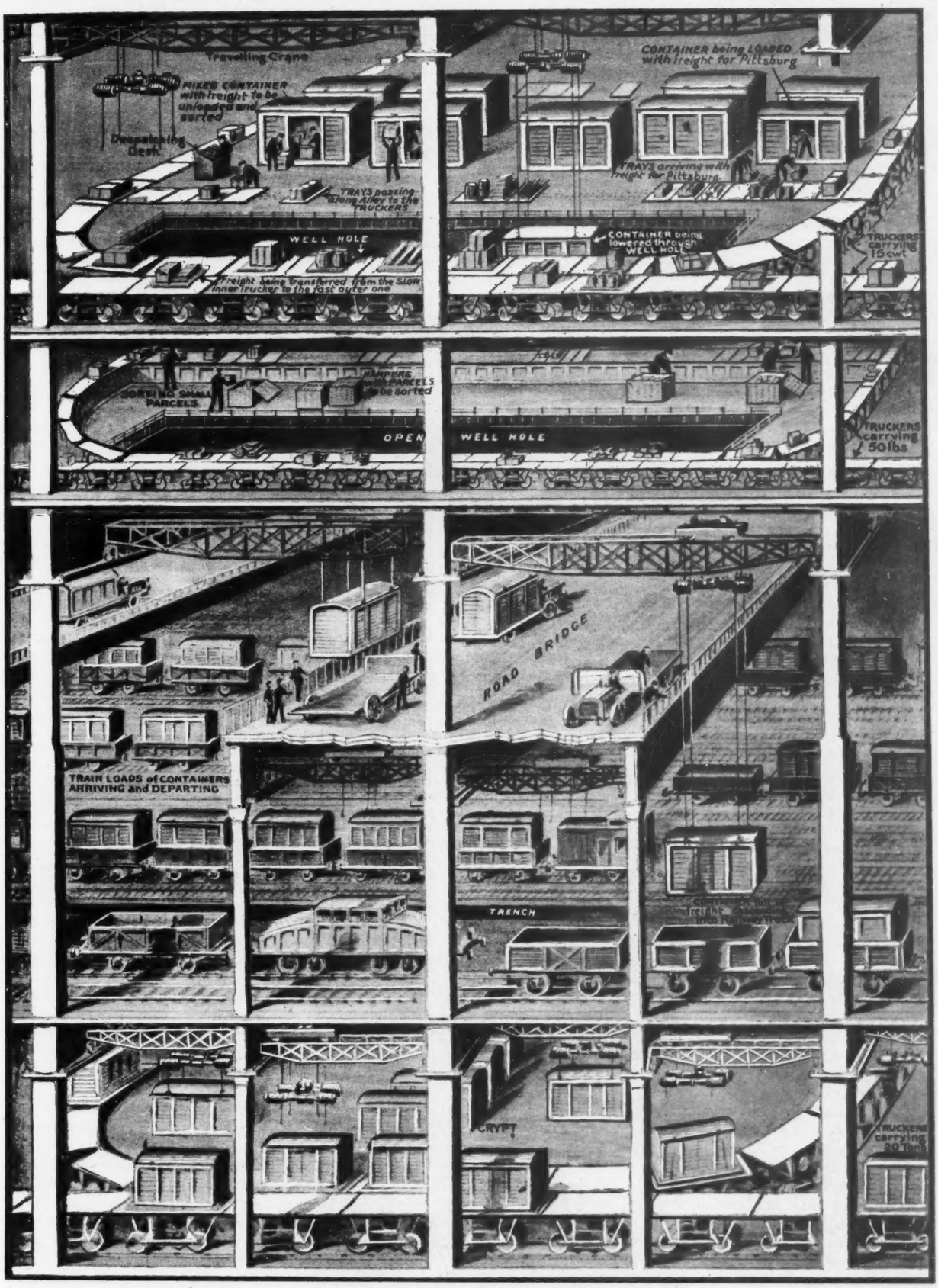
By this means manhandling is reduced to a minimum, and simply consists of adjusting the cargo slings for lifting or releasing packages, while movement of the cargo is almost continuous from the time it leaves the hold until deposited where required—an enormous advantage, reducing congestion to a minimum. To load a ship the process is simply reversed.

### *The Clearing-House for Freight*

This in brief is the port system for the rapid loading and unloading of ships. Let us now consider the central freight clearing-house that Mr. Gattie would erect in Chicago, St. Louis, and inland towns — indeed, wherever there is an important freight junction.

In cities and large towns served by a number of important railways, each company usually runs its own freight-yard and warehouses, with the result that sometimes a great number of independent freight-yards exist miles apart.

By the substitution of a central clearing-house, land would be released for building or other purposes; freight-yard shunting—the curse of rail-


Travelling Crane
MIXED CONTAINER with freight to be unloaded and sorted
Despatching Desk
TRAYS passing along Alley to the TRUCKERS
WELL HOLE
Freight being transferred from the slow inner trucker to the fast outer one
CONTAINER being LOADED with freight for Pittsburg
TRAYS arriving with freight for Pittsburg
CONTAINER being lowered through WELL HOLE
TRUCKERS carrying 15 cwt
SORTING SMALL PARCELS
OPEN
WELL HOLE
TRUCKERS carrying 50 lbs
ROAD BRIDGE
TRAIN LOADS of CONTAINERS ARRIVING and DEPARTING
TRENCH
CRYPT
TRUCKERS carrying 20 cwt

## The Clearing-House for Freight

In the clearing-house all switching is avoided. Instead the container system is employed. The container can be hoisted from one vehicle to another. A train of fifty cars enters the clearing-house, stopping between two narrow platforms. Above each car is a powerful crane. The men on the platforms hook the containers to the cranes, and immediately the train is relieved of its load. All the cars that contain through traffic for other lines are unloaded into the crypt. Powerful machinery is installed in the crypt, and any load dropped into it is immediately transported without shock or concussion to the exact box from which it can be most conveniently maneuvered

ways, by which more time and energy is wasted and more damage and accidents to goods and rolling stock are caused than in any other way—would be almost eliminated; the idle periods in the life of locomotives and freight-cars would be reduced to a minimum; and rapidity in transport and delivery of goods would be expedited beyond belief.

Mr. Gattie's clearing-house would consist of a great building 1,300 feet long, 500 feet wide, and 200 feet high, covering 15 acres, the basement extending beyond the walls and covering an area of 30 acres. It would be connected by underground electrified lines with all the main railways serving the district, these lines branching out within the building into a great number of sidings on to which freight trains are drawn by electric locomotives.

### *Traveling Cranes and Sorting Floors*

Spanning across the railway tracks are thirteen roadways, each fifty-two feet wide, carried on bridges and communicating with the streets; and above the roadways are four sorting floors. Overhead traveling cranes span the roadways, while others run below the roadways and span the tracks. The upper floors are provided with a system of traveling truckers circulating past well-holes in the floor, and truckers are provided in the basement, or "crypt." Of course, only trains with goods secured in standard "containers" should be allowed access.

A trucker consists of a truck, provided with rollers capable of revolving, and supporting trays containing parcels in such a manner that the trays may be transferred by the rollers from a stationary or moving trucker to or from a platform, or to another stationary or moving trucker. These truckers constitute a distinctive feature of Mr. Gattie's schemes, and are a truly wonderful invention. You may have two parallel lines of them, one traveling at three and the other at six miles an hour. Supposing a parcel to be placed on a slow-speed trucker, A: as it approaches or overtakes another fast moving trucker, B, it is literally true that B tries to grab the parcel, but cannot unless A wants to part with it, and the marvelous thing is that A knows exactly which trucker to deliver its load to, and won't deliver to any other.

Assuming that a number of trains belonging to different railway companies and coming from all parts, instead of being run into various freight-yards miles apart, are brought directly into the clearing-house, the *modus operandi* is as follows: Containers filled with goods intended for transfer complete from one railway to another are simply transferred bodily from one train to another, while those intended for dispatch by road are hoisted up and deposited on motor-lorries. In this way it is claimed that a heavy freight train can be unloaded and reloaded in fifteen minutes.

When its contents have to be distributed, the container is hoisted to one of the sorting floors or lowered to the crypt, where the parcels are distributed by the traveling bands into certain bays (of which there are 1,630), whence they are transferred in bulk.

In this way parcels intended for a certain destination, after being mechanically conveyed from trucker to trucker and from floor to floor by means of elevators to which they are delivered and from which they are automatically discharged on to other truckers, at last find their way to a specified bay, where they are collected, placed in other containers, and lowered on to a vehicle for dispatch. Thus many of the trains leave the building, loaded to approximately the same extent as when they enter.

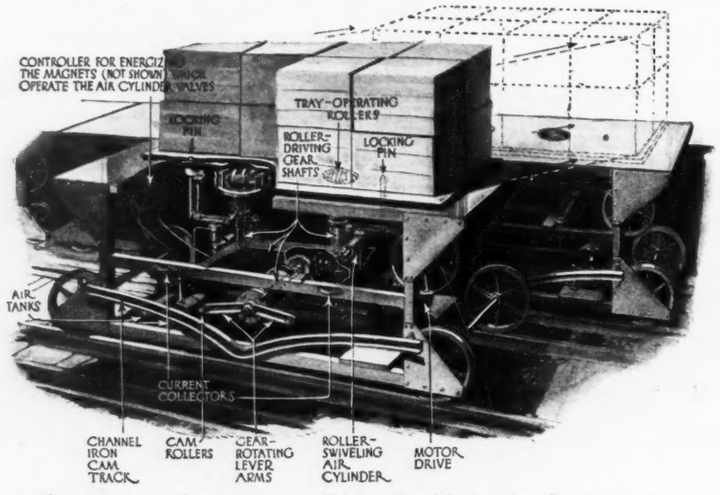
As projected in 1912, Mr. Gattie estimated the cost of such a clearing-house for London, including land, building, equipment, rolling stock, and tunnels, at £14,000,000 and the annual profit at £9,000,000 independently of the great economies to railway companies effected by the redemption of land and economic and extended use of rolling stock.

The enormous saving of time and the increased use that could be made of otherwise idle or empty vehicles is too obvious to need exposition; but another advantageous feature is the lessening of congestion of street traffic. There is no question but that street congestion arises principally from the tremendous number of carriers' vehicles engaged in the collection and delivery of goods. A systematized method worked in conjunction with the clearing-house would eliminate the greater part of this congestion. Mr. Gattie gives an instance of what takes place daily and hourly:

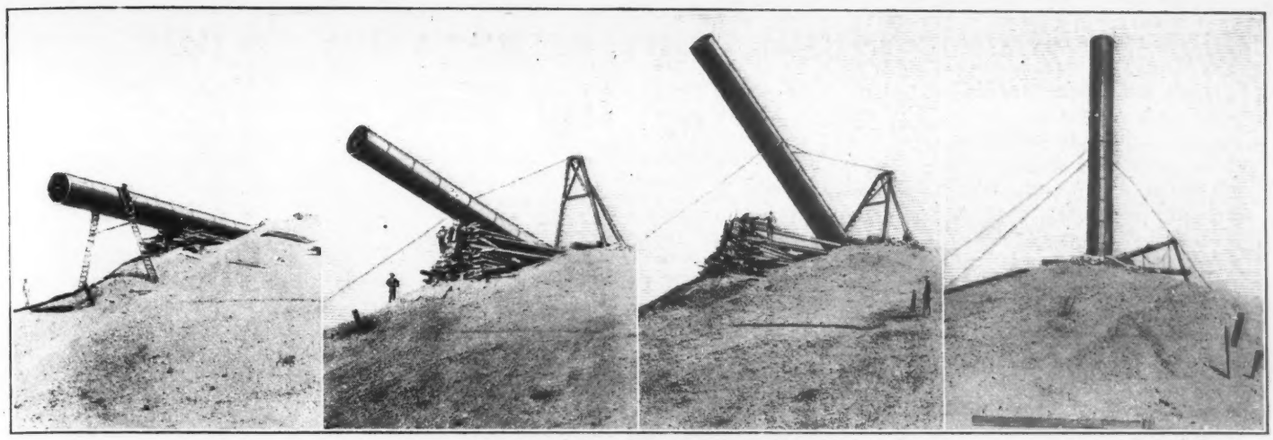
### *This Is Merely a Typical Case*

"You may have a narrow street blocked by a dozen or more carriers' vans, some perhaps with only one or two parcels to collect or deliver—in many cases several vans calling at the same building. The result is that carman No. 6, having finished his call and blocked fore and aft by other vans, lights his pipe and discusses the latest strike for a couple of hours with carmen Nos. 8 and 9, who are both waiting to deliver or collect at the same building! When at last the vans leave they swell the volume of slow moving traffic in the main streets. Central organization directed from the clearing-house and the adoption of the container system would easily render such cases impossible and relieve the main streets from much totally unnecessary traffic."

If such enormous improvements can be so simply effected, why do we plod along in the same old ruinous grooves? Because it is nobody's business; because of rivalry and jealousy between railway officials, between great firms of carriers, and even between port, city, and town authorities, and the lack of initiative to do the obviously right thing; because of the parsimony that prohibits the raising of the necessary capital and anticipated difficulty in reaching agreement as to how such capital and profits should be apportioned; because of apathy of government departments or lack of power to enforce the necessary cooperation and the need in governments of strong men with courage to initiate drastic reforms. In England the Ways and Communications Bill was introduced to effect reforms in methods of transport—whether, as passed into law, it will provide the necessary powers, remains to be seen.




Stevedores and porters are dispensed with in the Gattie system. Packages are mechanically sorted, transported, and delivered to the proper bay of the clearing-house. How is it done? By truckers of Mr. Gattie's invention. The trays on which the freight is carried are transferred from one trucker to another or to a freight platform by means of transfer rollers. These transfer rollers are raised vertically to lift the tray; they are swiveled for diagonal delivery; they are rotated to roll the tray to or from the trucker deck by gears actuated by a centrally pivoted lever arm. The lever arm is operated by one of two rollers at its ends, which rollers engage a channel-iron cam-rail on a trucker running on an adjacent track. The tray is rolled from one trucker to the other by a partial rotation of the lever arm. A postage stamp can be transferred by the truckers from any square inch of the vast floor of the clearing-house, transported and set down upon any other unoccupied square inch without touching or interfering with any other load, although the space may be crammed full of machinery



This smokestack blew away and was put in place again without the aid of machinery. It was pulled up the hill by a chain-block and then raised to a horizontal position by jack-screws. A steel cable was looped around the center of the stack, continuing on across a two-legged derrick and down to chain-blocks hooked to stationary logs on the other side of the hill; the cable and jack-screws raised the stack higher. When the jack-screws were no longer able to follow up the stack, the cable did the work alone; the derrick was hinged to facilitate the work. A concrete collar finished the job

# Putting a Wandering Smokestack Where It Belonged

A WIND-STORM tore a huge smokestack from its foundation and dropped it fifty feet away. As it plunged into the ground the top end flattened out. Later the owners came to view the remains. They decided that, if the broken end were cut off and the remainder straightened out, the stack could be used again.

But how could they get it back? The power plant at the smeltery to which the stack belonged was being overhauled, and the job would have to be done by hand. This meant that a stack weighing fourteen thousand pounds would have to be dragged fifty feet up a thirty-degree incline and then placed upright. The stack, which was in sections of ¼-inch steel plates, was six feet in diameter and seventy-five feet long.

First, the end was chopped off and the remaining flattened part forced back into shape by jack-screws. Two thirty-two-foot logs were placed on either side of the old concrete foundation, fourteen feet apart and parallel to the direction in which the stack had to be moved.

Another pair of logs were driven horizontally into the other side of the hill to the depth of one foot, to serve as the pulling point. A two-legged derrick was fastened to the two logs on the top of the hill, so that it had free play. While this work was going on, a new foundation was being prepared. The preparations finished, the stack was rolled in position for an uphill pull.

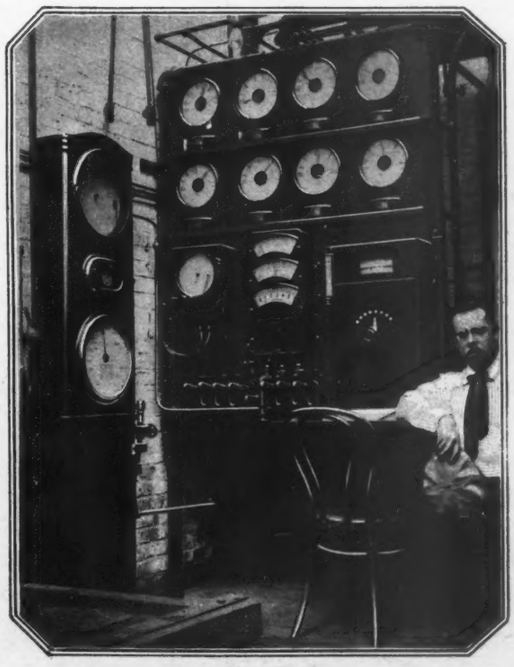
A steel cable was looped around the end of it and the stack was pulled to the top by a three-ton chain-block. The lower end of the stack was raised by jack-screws until the stack hung in a horizontal position. Next a steel cable was looped around the top end of the stack. The cable continued on across the derrick and down to the chain-blocks hooked to the logs stationed on the other side of the hill. The stack was then pulled into an upright position and lowered into its new base. A collar of reinforced concrete was poured around the stack and the job was finished.

# Out with the Weeds

WHERE do oats, peas, beans, and barley grow? Well, some of them grow in the back yard of George K. Caviness, in Seymour, Iowa. And they grow very well, for he constantly weeds and cultivates his ground. He does this with a special tool of his own invention — a three-pronged hoe which can be attached to a wheel and pushed.

A three-pronged hoe makes an excellent cultivator and weed-gatherer

# Keeping an Eye on the Boiler



Without leaving his corner in the boiler-room, he watches and controls his boilers

AN extremely valuable part of the boiler-room equipment is the boiler control board. This contains indicating and recording instruments for each boiler and the switches and levers for controlling the working conditions of the boiler plant.

By the centralization of the indicating and recording instruments and the controls within a small compass, a great deal of time and labor is saved and the efficiency of the steam-generating plant greatly increased. On the board shown in the picture are mounted steam flow meters, a draft-gage, a recording thermometer with two pens recording the temperature of the feed water entering the economizers and boilers, and a flue gas pyrometer connected to a thermo-couple in each uptake to indicate flue gas temperature.

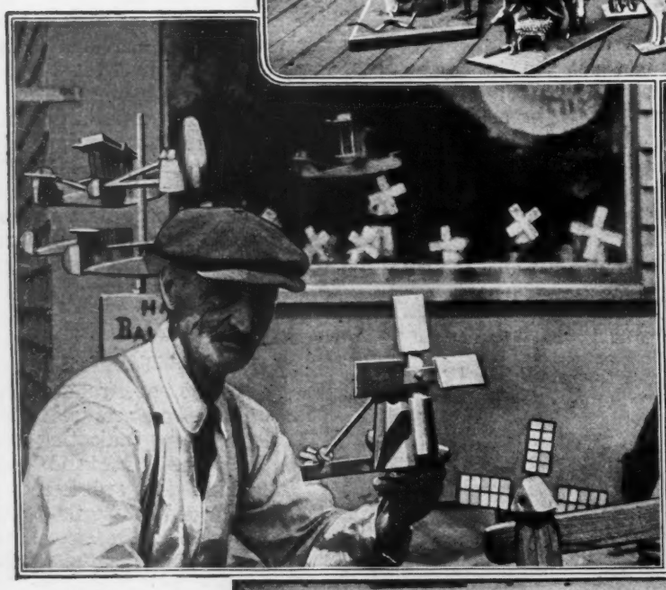
There are also a Venturi feed water meter, a gas collector and analyzer, and a flow meter.

# What They Whittle as They While Away the Time

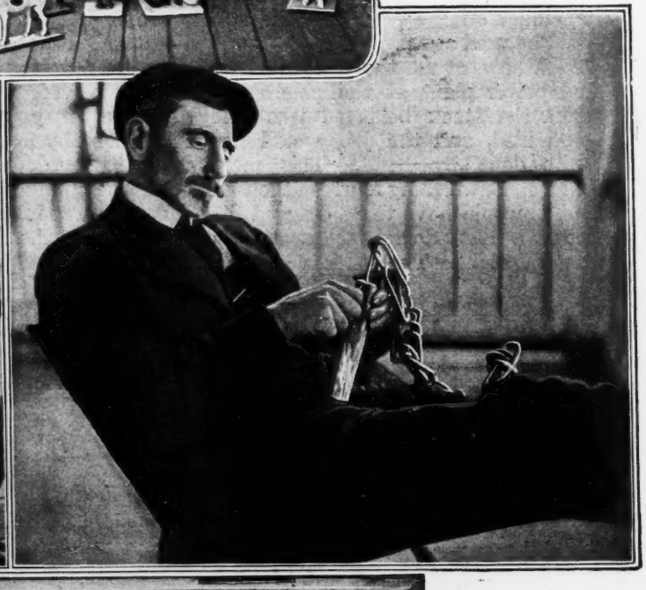
Philip Lisch, of Clinton, Iowa, made this fan, the pliers, and the star. He made the fan out of a single piece of wood. It was first split forty-five times, then each splinter was carefully bent outward to form the semicircle

Conrad Petty was everything from Deputy Constable to Chief of Police in his home town in Texas until he developed rheumatism. Now all his energy goes into carving blocks of wood

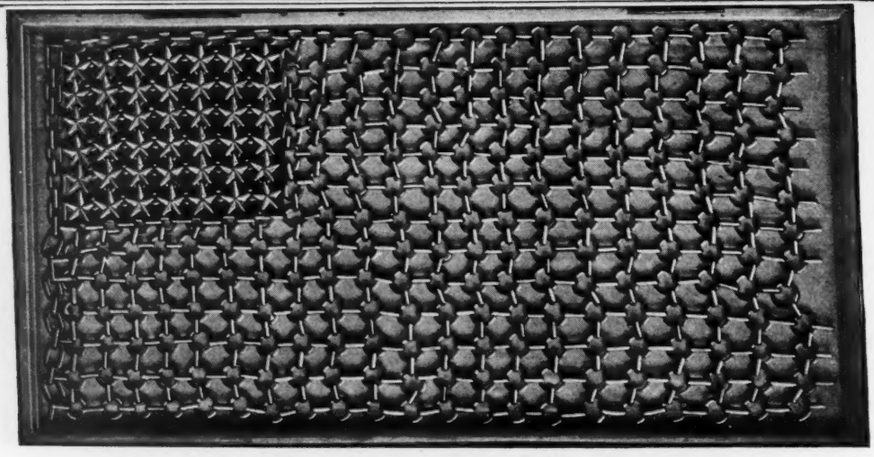
A pair of buffalo horns and three pieces of mahogany were turned into this emblem by a Filipino. It is much larger than it looks, measuring a full yard from the point of the dagger to the tip of the horns



Mr. A. W. Edwards, formerly a Cape Cod fisherman, also became a whittler; he is holding in his hand a reproduction of the famous old windmill of Chatham, Mass.



A man who vies for the title "Champion Whittler of the World" is here shown carving a chain out of a wood block. His strangely appropriate name is Lockwood

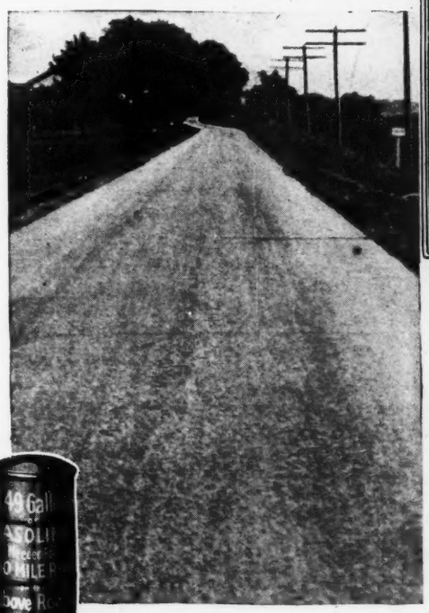


An Alaskan miner carved the American flag in the top of an apple-box. Seven hundred and seventy-one pieces linked together make up the stars and stripes

# Let Good Roads Save Millions

**There are more than 6,000,000 cars and trucks in use today. If each one was of two-ton capacity and traveled only 50 miles a day, the daily saving in gasoline over concrete roads, as compared with earth roads, would be 26,430,000 gallons, worth, at 25 cents a gallon, the tremendous sum of $6,607,500—and that for only one day in the year. For a 300-day year the saving would amount to 7,929,000,000 gallons or $1,982,250,000, a sum which makes what we are spending for good roads almost insignificant in comparison**

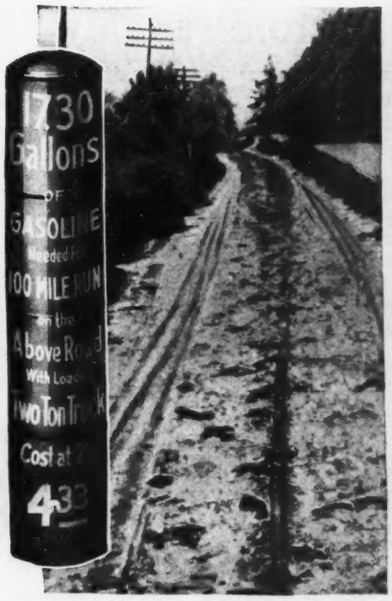
Below is shown a modern concrete road, over which a loaded two-ton truck was run 11.78 miles on one gallon of gasoline. This would amount to only $2.12 for a distance of 100 miles. In this particular case the motor-truck was in perfect mechanical condition



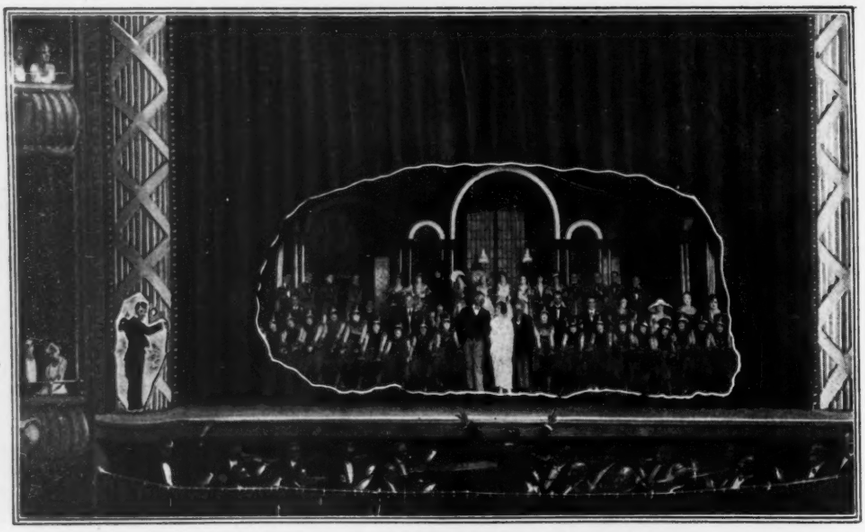
Above is shown a type of earth road that has caused great trouble throughout the country. The tanks, of varying capacity, shown on this page illustrate more clearly than could be done in any other way the exceptional economic advantages of good roads. The obvious connection between the quality of roads and gasoline consumption is very clearly shown

Brick roads, a little worn, decrease the mileage to about 9.88 miles per gallon of gasoline for a two-ton truck. This kind of road is fast giving way to concrete; for, besides requiring much attention and a long haul of bricks, its upkeep and repairs are very expensive

The age-old earth roads are the bugbear of motor-truck drivers; for in wet weather trucks usually sink in to the hubs, necessitating the hiring of mules to haul them out. In every case it is almost impossible to obtain traction for the rear wheels, and valuable time is lost. Even when the road is dry, the average mileage for a loaded two-ton truck is only 5.78 miles



The gravel road does not give quite as good a mileage as either the brick or the concrete road. It averages about 9.13 miles to the gallon of gasoline. Of course, good driving will help to raise this figure somewhat; but keeping the engine well groomed is the best advice that we can offer. Don't forget that it pays in the long run to have a good man at the wheel



The man secreted behind the left-hand pillar of the Metropolitan Opera House stage watches the orchestra leader through a peep-hole and duplicates his motions

## Getting Him Back on His Feet

HERE'S a new invention for the semi-invalid who is not strong enough to use crutches and not weak enough to need a wheel-chair; it is a combination of both. The upper part of his body is supported by crutches that terminate just below his waist in the frame of a wheel-chair. He sits on a bicycle saddle and his feet touch the ground.

The saddle is attached to the chair frame and the frame moves on rubber-tired wheels. A strap to support his back is fastened to the top of the crutches. Thus, in a half-standing, half-sitting position, he is able to move about and gradually strengthen all his limbs.

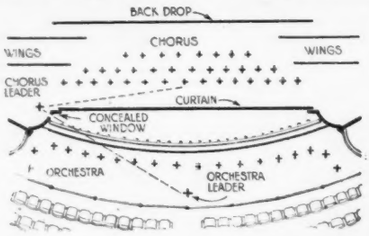
Whether the patient is recovering from a severe illness that has left him in a weakened condition, or whether he is a victim of war or accident, suffering from a broken leg, the walking-chair will help him in learning to walk again.

The crutches and saddle may be adjusted to different heights in order to suit the patient.

Half walking, half sitting, the invalid gradually strengthens his whole body in this new walking-chair, which supports him while allowing of exercise

## Leading a Chorus Around a Corner

FEW people at the opera or any musical performance where choruses are engaged realize the mechanical difficulties of an orchestra leader. It is obvious that every musician and singer must be at the instant command of his baton. The delay of a fraction of a second in obeying his signal may spell disaster. The problem of leading is complicated when a chorus or part of the orchestra plays or sings off stage. But the problem is not insolvable.




The chorus is out of range of the orchestra leader and follows the directions of a second leader

An ingenious plan has been adopted at the Metropolitan Opera House in New York for keeping every part of the great stage in touch with the leader. There is a small window in the elaborate decorations on a pillar at the left of the stage. This opening is covered with gauze heavily gilded. Now, if the leader wishes to direct a group of singers or players on the stage while the curtain is down, which is frequently the case, a second leader stands behind this covered window and duplicates every motion of the leader's baton. He stands in such a position that his own baton is in sight of those on the stage even when the curtain is down. So cleverly is this done that those on the stage hidden from the real leader almost never miss a beat.

An even more difficult problem arises when a chorus sings behind the scenes, out of sight of the second leader. It is often impossible for it to occupy a position within sight of the man at the lookout. In this case three and even four leaders are employed, all constantly in sight of one another. The motions of the leader before the curtain are thus repeated by the man at the lookout, who is in turn copied by the leader at the extreme back of the stage, who is duplicated by still another.

The complicated leadership of the baton is thus carried around corners, often for a hundred feet or more, without the loss of an appreciable fraction of time.

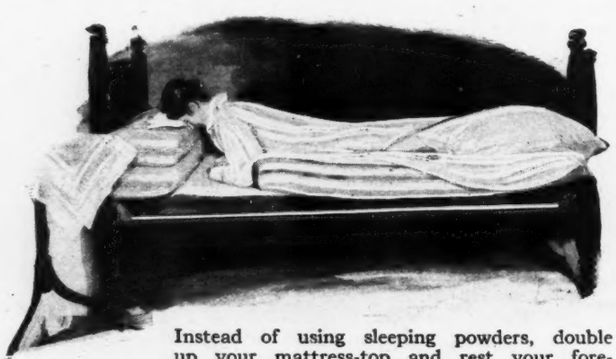
## Go to Sleep, My Lady

LIE face downward, with your forehead resting on a ledge, and you will surely go to sleep. So says Alice O. Darling, of Lebanon, N. H. She discovered this in her insomnia days, and promptly patented it.

Her invention calls for a two-pieced mattress. The upper section is again subdivided, but the two parts are held together by a binding.

In the day-time the mattress is stretched out after the fashion of any ordinary mattress, but at night the hinged section is doubled over to furnish a ledge on which to rest the forehead. In a little while you become drowsy; whereupon you put back the mattress, pull up your pillow from the bottom of the bed, and sleep.

The secret of this system, of course, is that the blood-pressure is removed from the brain.



Instead of using sleeping powders, double up your mattress-top and rest your forehead on it; this is the latest insomnia cure

# You Can Balance This Typewriter on Your Hand

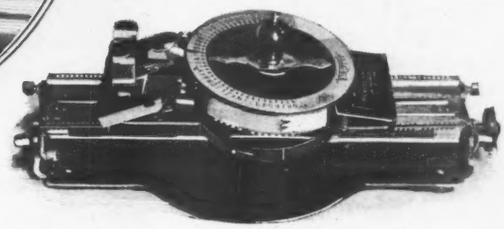
A TYPEWRITER small enough to be carried in your coat pocket and light enough to be held in your hand, if necessary, while you are writing your letter with it, has been invented in France and placed in the market by a French manufacturer.

It consists of two separate parts: the typewriting mechanism, which is enclosed in a small metal box; and the carriage, which holds the paper in writing. Ordinarily, if the typewriter is placed on a table or other suitable support, the carriage remains stationary, and the type mechanism moves from left to right across the paper; when it is necessary to hold the machine in the hand while writing, the type mechanism remains stationary, while the carriage with the paper held by it moves from right to left.

The type mechanism consists of two disks, the lower of which is rotatable and has on radially arranged tabs extending beyond its periphery raised characters representing the small and capital letters, numbers, and punctuation-marks. This disk is connected with an index hand with two pointers. The thinner of the pointers is used for the small letters, the broader for the capital letters. In writing, the pointer is turned to the desired letter marked on the rim of the upper disk, and a slight pressure on a button releases a little hammer which strikes the back of the letter and causes it to leave its imprint on the paper.

She is operating the miniature typewriter on a base resting on the table, but the machine may also be used merely supported in one hand

Although it is small enough to hold in one hand, it is perfectly equipped to write letters correctly



A miniature typewriter with which you may write letters while traveling

# Ink by the Tube

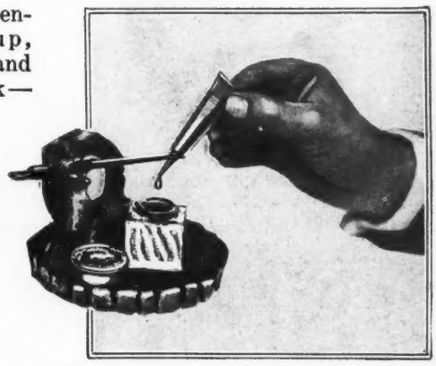
WE have concentrated soup, powdered eggs, and condensed milk—water being extracted from almost everything these days in order to save space and labor.

The latest is concentrated ink. It comes in tubes—like tooth paste—and you squeeze it out drop by drop, mixing it with water at the well known ratio of sixteen to one. Thus one large drop of concentrated ink, when dissolved in water, will be sufficient to fill an inkwell of average size.

The tubes come in three sizes, the smallest holding enough ink paste to make a pint of ink, and the largest holding enough to make a gallon.

Of course, no one is apt to want a gallon of ink at one squeezing in order to write a letter, but the paste will keep in its concentrated condition for a long time, if the cap is kept screwed in place. In this respect it again resembles tooth paste.

Be careful not to mix them up in the dark.



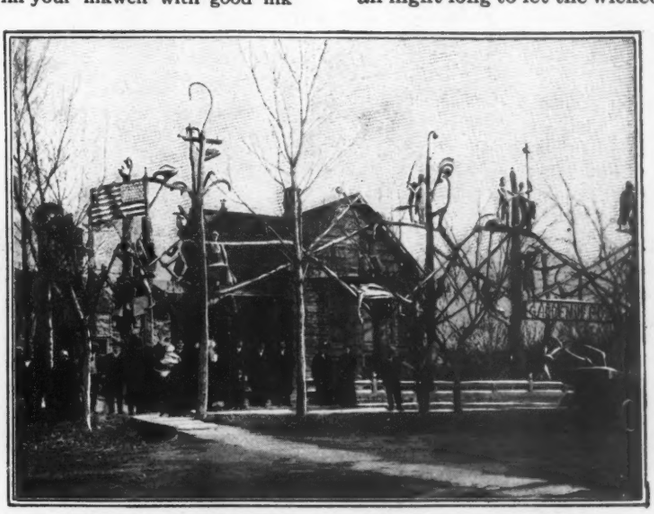
One drop of concentrated ink squeezed from a tube and mixed with sixteen drops of water will fill your inkwell with good ink

# Seen in the Garden of Eden

ADAM and Eve in the Garden of Eden—how we envy them their care-free life in that charming spot. One of us, S. P. Dinsmoor of Lucas, Kan., has gone so far as to build a concrete "Garden of Eden" around his house. But what a strange, ugly garden it is—not the least bit enchanting. And the reason is that the garden was built as a frightful warning to the wicked world of the sins that it should avoid.

Adam and Eve in unshapely concrete are holding up the destructive serpent—Adam balancing his share on his head. A concrete tree on either side of them supports a large sign, "Garden of Eden." On top of this sign a misled saint is balancing himself. Near by another saint is swinging merrily. But just beyond him is a pole that carries at its top the "Evil Eye." This blinks ominously all night long to let the wicked know that the devil is on their trail. Electricity does the blinking, and the devil, by the way, is stationed but a few trees away. Altogether there are one hundred and twenty-seven concrete inmates—good and bad—perched in the cold branches of the concrete trees.

The most puzzling feature of the whole garden is the American flag fluttering in the breeze above the main entrance. We have been led to believe that Eden was located in Asia. But even if it were, by chance, located in America, there was no such thing as the stars and stripes in those early days. Besides, we don't like the idea of associating the flag with a collection of sins.

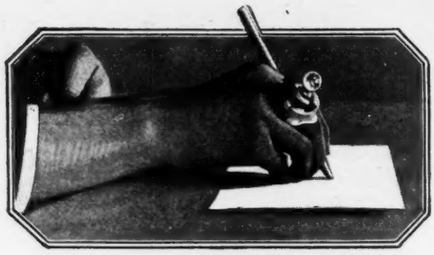


This is the Garden of Eden; if you doubt it, look at the sign. It is made of concrete, of which forty-three tons was used. The maker is the man with the long white beard

# Charting a Champion

## Why is one man better than another at a drill-press? And why is one golf-player better than another?

By Walter Bannard



The cyclegraph—an electric light attached to the hand or other moving part of a person or a machine in motion

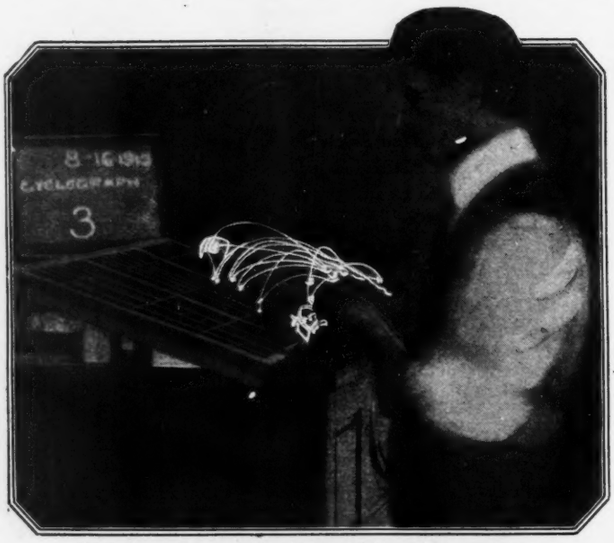
IF you want to learn how to play the violin, the best teacher ought to be the greatest violinist. To learn how to play tennis, golf, or even croquet, avoid the average player; he will never make a champion of you. To become a champion yourself you must learn from a champion. Very few champions are good teachers in the sense that they can tell you what to do and how to do it. Often they have entirely wrong theories about their own procedure.

### *Finding a Unit of Measurement*

That has been the experience of Frank B. Gilbreth of Providence, R. I., a distinguished efficiency engineer who is regarded both here and abroad as the greatest authority on motion study. Gilbreth found that he must establish a unit of measurement and that he must record his subject's motions.

The best fencers, the best baseball-players, the best golfers have permitted Gilbreth to cross-examine them. Since they only theorized about themselves, since they told him that they did one thing, but actually did another, quite unconsciously, he had to disregard all that they said and measure them with the aid of some instrument.

That instrument Gilbreth himself invented. He calls it a "cyclegraph." He wanted something that would visualize the path of a typesetter's or a billiard-player's motions. He tried the motion-picture machine with some success, but it was not possible to summarize all motions of a cycle or operation in any one series of pictures; so he devised his cyclegraph, describing it thus:




A cyclegraph made by Major Gilbreth in order to study the motions of a compositor setting type by hand and according to the simplified spelling system

### *How the Motion Is Recorded*

"This consists of a small electric light attached to the hand or other moving part of the person or machine under observation. The motion is recorded on an ordinary photographic film or plate.

The path of the motion stands out in two dimensions.

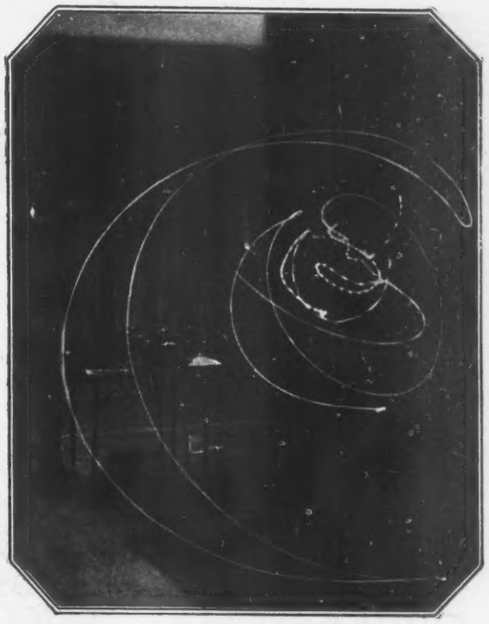
"By taking the photographic record stereoscopically we see the path in three dimensions; that is, length, breadth, and depth. It did not, however, contain the time element. This time element is of great importance, not only for comparative or 'relative' time, but also for exact time. This time element is obtained by putting an interrupter in the light circuit, so as to cause the light to flash at an even rate at a known number of times a second. This gives a line of

John Barrett making ten cycles of taking the pencil out of his left-hand pocket; yet this was the pocket in which Mr. Barrett customarily kept the pencil

This chrono-cyclegraph shows the paths made by the hand of John Barrett, president of the Pan-American Union, while taking a pencil out of his right-hand pocket, he having been accustomed to taking it out of his left-hand pocket. Compare this with the picture on the right, showing him taking the pencil out of his left-hand pocket in the usual manner

Here Mr. Barrett is shown making one cycle of the motions he commonly executes taking the pencil from his vest pocket; compare the picture opposite

On the left is a cyclegraph photograph of James Barnes. A light is attached to the head of his golf-stick. "Don't move your head," is one of the maxims of golf. But this cyclegraph of Barnes, made by Frank B. Gilbreth for Walter Camp and *Golf Illustrated*, disproves the maxim utterly. All champion golf-players move their heads, as Gilbreth's photographs abundantly prove



Gilbreth attached five electric lights to Richard Hovey in order to chart his motions while making a full drive in golf. Note that the downward stroke does not follow the upward stroke, all golf conventions notwithstanding

time spots in the picture instead of a continuous light line. Counting the light spots tells the time consumed.

"The next step was to show the direction of motions. . . . The light spots are pointed at their forward ends. The points thus, like the visual symbols of arrowheads, show the direction."

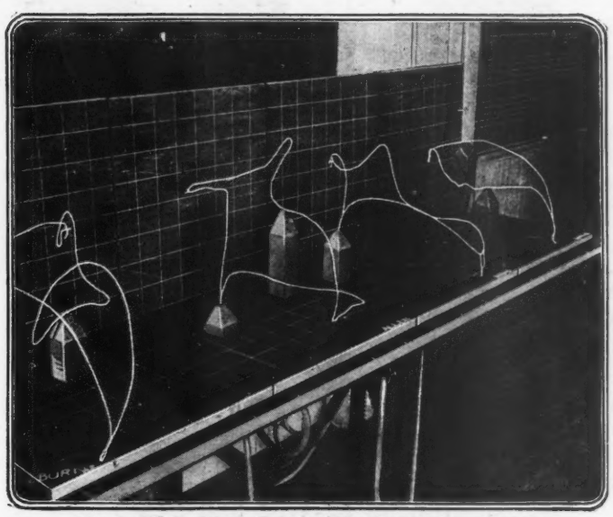
### *We Can't Judge Our Motions*

The cyclegraph, as Gilbreth applies it, has shown that none of us can tell how he performs motions. Ask a compositor how he sets type by hand and he will surely give you a wrong answer. He isn't trying to deceive you; he simply doesn't know.

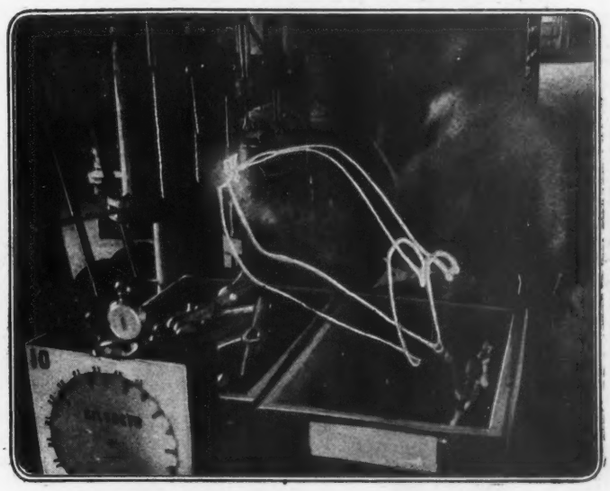
He has at least three ways of performing his task. In the first place, there is the way that he adopts when he is thinking, not of what he is actually doing, but of the ultimate result. Next, there is the way that he adopts when he is asked to instruct another. The third is the way that he follows when he thinks that he is illustrating his own method—which, strange as it may seem, is not the same as that adopted for instruction.

### *Golfers' Axioms Are Not Facts*

It is one of the axioms of a golfer that the up swing of a club should be exactly the same as the down swing.



This cyclegraph shows that habit plays an important part in this man's work. Why? Because the hand follows nearly the same path over and over again



These models preserve the motions of a man on a drill-press during the process of learning. Note the improvement indicated in the last model over the first; all hesitation is gone

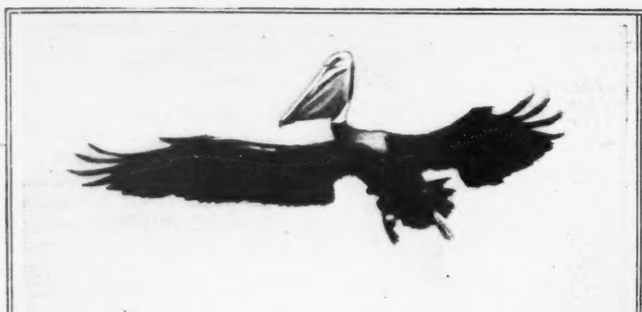
By attaching a light to the club, Gilbreth has shown that the two arcs are not the same and that the down swing is noticeably closer to the body. "Don't move your head," is another principle dinned into the head of the novice. But Gilbreth's cyclegraph records of a great champion like Barnes show that the best players do move their heads notwithstanding.

### *Fundamental Rhythm of Motion*

Why should an efficiency engineer bother with golf-players? It is Gilbreth's theory that all manual work, whether it is a surgeon's, a bricklayer's, or a tennis-player's, is alike in this: It possesses a fundamental rhythm.

The natural laws and underlying principles resulting from the design, selection, standardization, care, and use of tools can be discovered as surely as mathematical laws, and these laws are the same for all tool-users, all trades, all outdoor games.

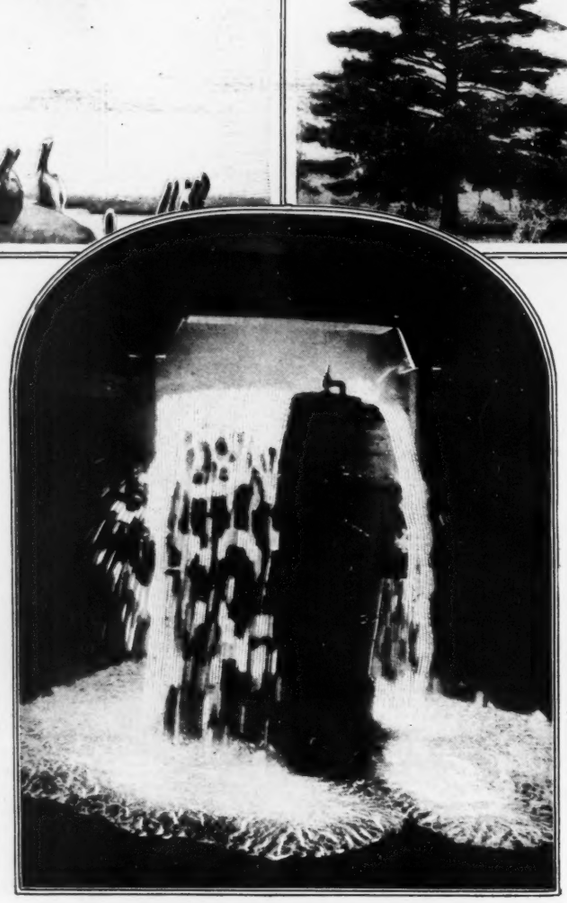
This is the reason why Gilbreth has studied the most skilled handkerchief-folders, the most skilled surgeons, the fastest bricklayers, the quickest typists with his cyclegraph — all to reveal the astonishing fact that a champion does not know why he is a champion.



## A Flying Pelican Looks Like a Japanese Print

GLANCE at this picture of a pelican flying, and you will understand that, while the bird may stand for the limericks that are written about it, it prefers to sit for its portrait.

Our bird is one of the colony at the United States Bird Reservation at the mouth of the Mississippi, where fifty thousand pelicans have been counted on the "Mud Lumps." As soon as the young are able to paddle about, their parents are kept busy fishing to satisfy their appetites. The old birds come in from the fishing grounds, says Alfred M. Bailey, of the Louisiana State Museum, in a long string formation, "flying with carefully timed strokes, and scaling so close to the water that it seems as if they must strike the surface at every beat."



## A Study in Tree Heredity versus Environment

EVEN the trees of the field offer striking examples of the retentive power of heredity and the influence of environment, as is evidenced by this tale of two trees.

In a field near Mont Alto, Pa., stand two trees of the same age which developed in an identical environment. Being of different species,—the one on the left a white pine, and the other a yellow pine,—they possess unlike inherent tendencies and consequently developed entirely dissimilar forms.

The white pine, an adaptable tree, developed a rather broad and high crown with the lateral branches persisting almost to the ground; while the yellow pine produced a narrow and shallow crown and a bare trunk for almost three fourths of its height.

## It's Wise to Train Them While They're Young

AFTER reading in one of the newspapers that a few railroad workers have larger salaries than the Governor of New York State and that many of them earn more than majors in the United States Army, the wise mother of the boy shown in the picture below bought him a "kiddie-car" and let him play locomotive engineer to a train of wagon trailers.

Like all children, this youngster loves his "kiddie-car," and to it has now been added the joy of dragging around loads of dirt, sand, or any other material neccessary in his particular line of business.

The earnest-looking little boy in our picture is evidently contemplating some very difficult and important task.

## Sinews of War and Peace

STEEL and still more steel is the rallying cry of both the peace and war battalions, whether it's cannon and shells or railroad tracks, girders, and rivets that are in special demand; but it is not often that we get so dramatic a view of steel in the making as the photographer caught at a rolling-mill in Coatesville, Pa.

The giant crucible—it holds hundred tons of metal and is said to be the largest in the world—is spilling out molten metal—the life blood, it might be called, of modern industry.

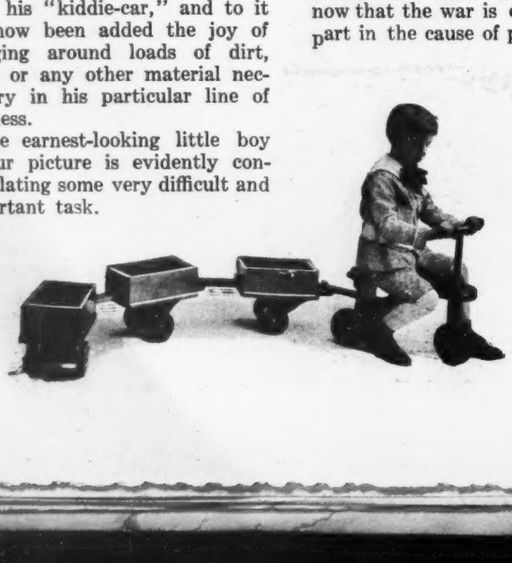
This great crucible fathered enormous quantities of the metal that helped drive back the German armies. And, now that the war is over, it is willing and ready to do its part in the cause of peace.

## The Dog that Wheels a Baby Carriage

DO you find nurse-girls hard to get? Then buy a dog, stand him on his hind legs, and back the baby carriage into him. He will clutch at the handle with his front toes in order to balance himself. Do this several times and he will grow attached to the handle.

This is exactly what you want. Teach him to push the carriage, and then you may be reasonably sure that he won't let go. Dress him up in a cap and apron and let him be your nurse.

Are you skeptical? Look at Toutou, here. He is a Parisian nurse, and walks along the Boulevard Wagram every afternoon pushing his carriage before him. It is even said by persons of veracity that he crosses streets, observes traffic rules, and barks at careless chauffeurs.



## Carry a Spy-Glass in Your Vest Pocket

"OH, if I only had an opera-glass!" sighs the bird enthusiast, as he glimpses a feathered unknown in the branches above; and his wish is often echoed by other folk who may not be amateur ornithologists, but who long for a nearer and clearer view of something that has caught their eye.

No need goes long without an answer. In this case the answer is a folding opera-glass, built on the principle of the spy-glass, which when closed will go easily into a vest pocket.

Not only is the little glass very compact, but to some extent it can be adjusted to fit the spacing of the eyes of the user, whereas in the familiar type of glass the eye-piece is fixed to accommodate those of the average person, often to the discomfort of one whose eyes are set more closely together or more widely apart.

## A Trolley Car in Gold and White

IF, by chance, you should go some day to Calgary, Canada, remember this: you will not need to hire an automobile or pay a high price for a seat in a bus in order to see the town. Why not? Because the street-car railway owns an elaborate sight-seeing car that makes regular trips each day in the course of which it covers all the trolley tracks in the city.

The obliging conductor points out the public library, residences of local magnates, leading churches, and other points of interest, besides collecting fares with great regularity.

The car seats, which run crosswise, are graduated like those of a theater. A canvas canopy, supported by white enameled posts, acts as the roof of the car. Great mirrors adorn the sides of the car—which, by the way, is attractively finished off in white and gold.

## They Say He's Three Centuries Old

YOU are here introduced to Peter, the giant tortoise of the London Zoo. Since his birth was not registered, we are unable to tell his exact age; but experts assure us that he is considerably older than any of us, the day of his birth dating back two or three centuries. His age accounts for his great size—he has never stopped growing.

We wonder what Peter's thoughts on civilization are as he wanders around his section of the Zoo. Has he ever seen an airplane? Probably not; he keeps his head too close to the ground.

He was once as small as the tortoise seen crawling on his back. We hope that when the little fellow reaches the front edge of the shell he will crawl back where he came from. He is no match, we fear, for his fellow tortoise.

## Not a Watch—an Ash-Tray

LAUGH no longer at the ladies who have turned their lockets into powder-boxes; here is a man who uses his empty watch-case as an ash-tray. He carries it in his watch pocket and takes it out whenever he wishes to smoke in houses where no ash-trays are provided. Then, when he reaches the street, he empties out the ashes.

The idea is recommended specially to those men who scatter cigar ashes broadcast, meanwhile announcing that ashes are good for the carpets.

It is also meant for the man who carries a broken watch in his pocket because he likes to wear a watch-chain. He never can tell you or himself the time of day, so would it not be just as well if he dug out the stuffings and left his case free for ashes?

Of course, the larger the watch-case the greater will be the number of cigars you can smoke before it is necessary to empty the ashes. We recommend frequent washing of the receptacle—and be sure it's a tight-fitting watch-case.

## If You Let Your Finger-Nails Grow

ONCE a year the Chinaman below takes a day off and manicures his finger-nails, and he is busy all day; for three of his nails are very long and likely to be dirty, even though they are encased in bamboo stalks all the year round. You see, this Chinaman has the longest nails in existence, and he is very proud of them. The longest one is thirty-one and one half inches long, the next measures twenty-one inches, and the smallest but six and one half inches.

The twenty-one-inch nail was about to undergo its annual thorough overhauling when this picture was taken, and it is shown without its casing. It looks very much like one of the bread-sticks that bakers used to sell.

It must be a rich Chinaman who can afford the luxury of such elongated nails, for surely they must interfere with any kind of work; in fact, he must find it difficult to sleep and eat in comfort. But the glory of being the finger-nail champion of the world is probably worth it.

# Keeping the Surgeons and Firemen Busy

Assisted by a lighted match, this gentleman went hunting for a leak in his carburetor. He realized (too late) that gasoline leaks should be trailed with an electric torch or left until daylight

## HELD A LIGHTED MATCH TO GASOLINE TANK OF AUTO.

**Explosion Follows—Chauffeur, Badly Burned. Taken to Hospital in Dying Condition.**

As a result of lighting a match to discover a bit of wood in a gasoline tank, Max Lieberman, a chauffeur, nineteen of No. 51 Varet Street, Brooklyn, is dying in the Cumberland Street Hospital with burns on the head, face and shoulders.

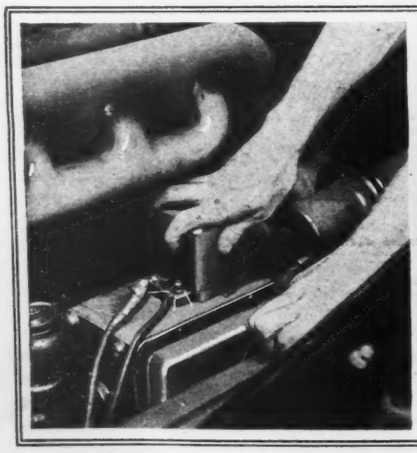
Be very careful when throwing away lighted matches. Oily rags are easily ignited

Every one has seen the costly repairs made upon cracked cylinders. One way to crack them is to pour cold water into a hot radiator and cooling system. Wait until the engine cools

Cleanliness is just as necessary to your car as it is to your person. Act accordingly

The worst firebug of all is the carburetor "back-fire." When you adjust the carburetor for a better mixture, don't race the engine; for that *popple-pop-pop* means a fire, and sometimes it means a serious conflagration

Gasoline, oil, and grease everywhere. Yet the repairmen smoke. One garage-owner who despaired of getting results by talking painted the sign: "Don't Smoke —If Your Life Isn't Worth Anything, Gasoline Is"



What a display of sparks occurred when you took off the generator cover and dropped it on the commutator. You had a lucky escape. Remove one of the wires next time

If the puddle of gasoline beneath your car catches fire from a carelessly thrown match, the car will probably go up in smoke. Better keep the gasoline system tight

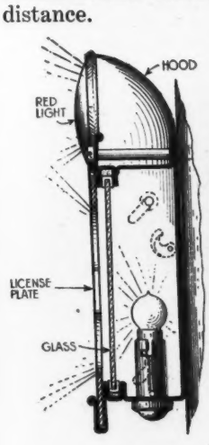
If your brakes are too tight, the burning smell will warn you. If you disregard the warning, some day you'll have a bad crash because the lining will have burned away

## This License Plate Can Be Read at Night

HOW to reduce the numerous fatalities and injuries caused by reckless automobile driving is a problem that is causing considerable thought throughout the country.

An invention brought out by Otto Gropper, of Long Island City, N. Y., ameliorates to a decided degree the present existing conditions. The tail light is combined with the license plate, its numbers being punched out, so that the light shines through, rendering the number easy to read by night as well as by day. With this invention the speeder's car number can be taken with the least difficulty.

To steal a car with this attachment a thief would have to replace the whole rear lighting arrangement. The plate is impossible to duplicate, and therefore serves a twofold purpose—that of preventing substitution and that of giving a clear license which can be seen at some distance.



A new type of license plate which can be seen clearly by night as well as by day and which cannot be substituted

Touring in your own hotel is something new. The truck shown here affords every convenience, with the advantage of being placed where the view is best

## The Hotel Automobile Is Here

A MOTOR-TRUCK manufacturer has produced a unique vehicle that has practically enabled him to take his "hotel" with him when he journeys long distances by motor, as he did recently, with his wife and a party of friends. This was a long trip from the city of Marion, Ind., to California, and back, a distance of four thousand miles.

The "hotel" is a completely fitted out body on a two-ton motor-truck chassis with pneumatic tires. The vehicle contains sleeping compartments for several people, with glass windows on each side. Beneath each compartment there is a clothes-chest. The rear of the truck body is completely fitted up as a kitchen, or perhaps, to be accurate, we should say kitchenette.

It is also provided with a lighting system, and is equipped with water-tanks, a pump, and sanitary plumbing.

Besides being independent of hotels, the happy owner of a car like this never has to hurry to catch a train.

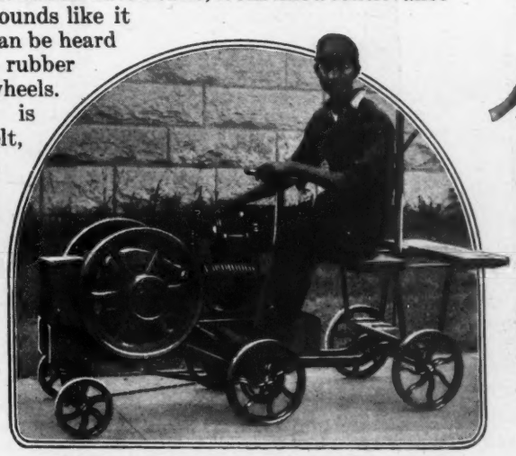
## It's Called a Mechanical Mascot

THE craziest machine known to the automotive world is in the possession of the engineering department of the Kansas City Agricultural College at Manhattan, where it is known as the "mechanical mascot."

Every bolt, nut, pin, and beam that went into the machine was made in the college shops.

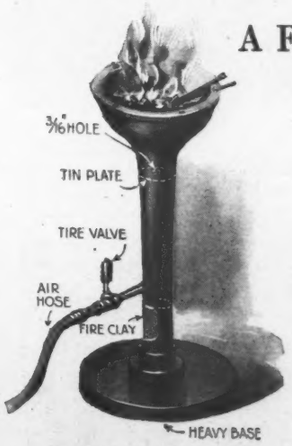
The machine runs like an automobile, looks like a contrivance of the devil, and sounds like it too. Its exhaust can be heard a mile away. No rubber tires grace the wheels. Its transmission is a crude leather belt, and its clutch an iron rod. It has neither reverse gear nor springs. It accommodates two passengers.

The college engineers are very proud of their work, and never overlook an opportunity to exhibit the mascot.



Poy Lim is in the driver's seat, all ready to step on the accelerator. Beware, pedestrians!

## A Forge Made of an Old Rear Axle




A tin plate, fitted inside of the round part of the housing, near the top, holds the coke

A FORGE for use in a small repair shop may be made out of half of an old Ford rear axle housing. It may be used for straightening bent frames or other pieces of metal, and for beating them into different shapes.

In manufacturing the forge only the outside housing of one half of the axle is used. It is set up on its smaller end on a heavy base to keep it upright; but the base must not be so heavy as to make the device difficult to move from place to place.

A tin plate is fitted inside of the round part of the housing near the top, to hold the coke. The air is led into the base of the stand from a hose with a tire-valve, and then up through a small hole in the center of the plate supporting the coke.

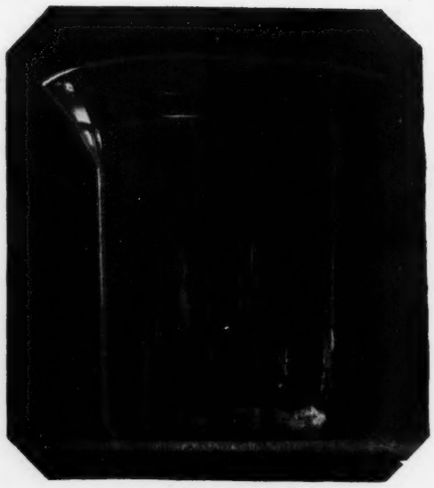
The air for operating the forge may be forced through the bed of coke by an ordinary hand tire-pump or, better, from a small compressor if this is available.

# Can Man Create Life?

## Scientists produce plants that actually grow and blossom

A small crystal of nickel nitrate dropped in a sodium silicate solution will quickly develop into the plant shown above; you can actually watch the tendrils shoot up, since it takes but ten minutes for the plant to grow to its full height

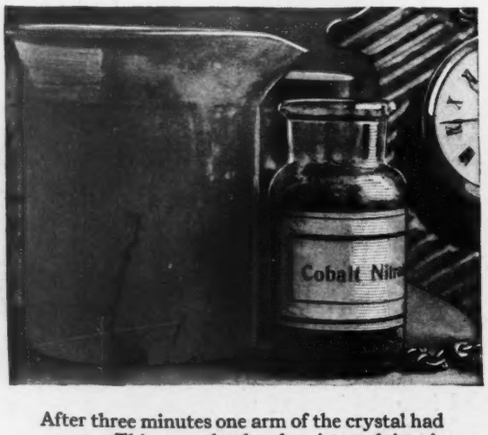
When a cobalt nitrate crystal is dropped into the solution, it is red; but as the plant develops the crystal turns green. The plant itself is one-celled, as are the plants that grow at the bottom of the ocean



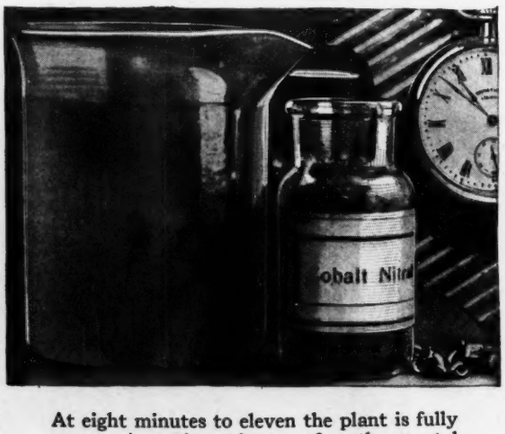
From one crystal of manganese sulphate many protuberances will grow, and from each of these will spring many shoots; but, even though these artificial plants will grow and blossom, they are lifeless and cannot reproduce

This looks like a typical example of marine plant life among the corals, but in reality it is a tank full of crystals ten minutes after they were dropped in; the plants are several colors

At seventeen minutes to eleven a crystal of cobalt nitrate was dropped into the water-glass solution; note in the two pictures below the speed at which it developed



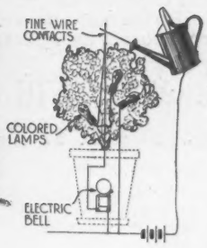
After three minutes one arm of the crystal had grown. This growth, the chemist explains, is due to osmosis—the diffusion of two liquids of different densities through a thin partition



At eight minutes to eleven the plant is fully grown—just nine minutes after the crystal was dropped into the tank. It has twigs, leaves, and protuberances that greatly resemble fruit

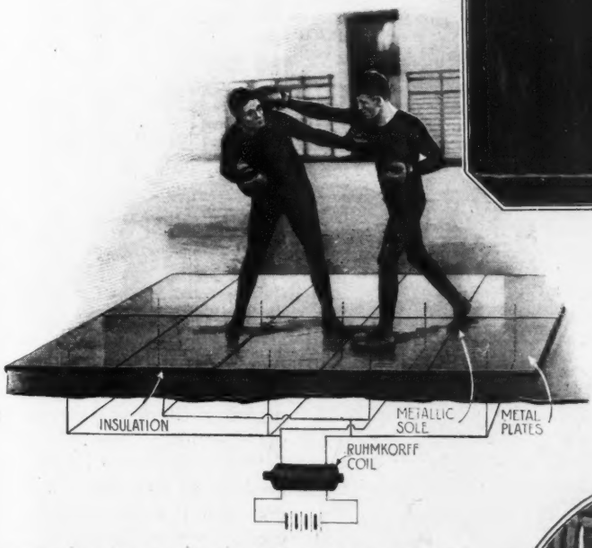
# Isn't the Stage Shocking!

## Actors are charged with electricity and currents are planted in the flower-pots



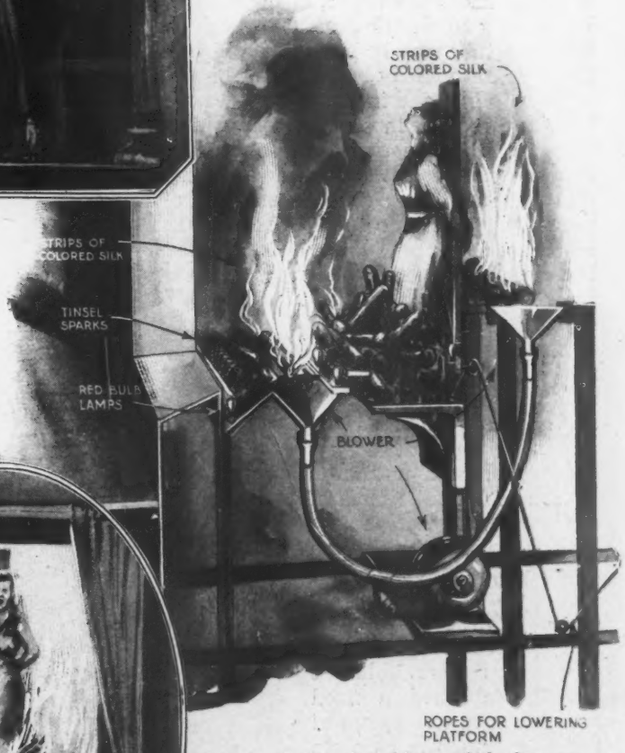

The flowers that bloom in the pots, tra-la, have nothing to do with the can. The watering-can contains, not water, but a live wire that projects a little beyond the spout. As the hero enters through a bower of roses, carrying the can, you naturally assume that he is going to water the flowers. But no; he touches the live wire to another wire concealed in the flowers, and lo! a bell sounds and the pot lights up. Each bell has a different tone, and he plays a tune with his watering-can, thus attracting the attention of the 'cello-playing heroine

He clicks bones for a living, and sometimes he has clicked in vain to an unappreciative audience. But he needs must live, eat, and buy new flowers for his buttonhole, so he has electrified his bones in hopes of electrifying his audience. Every time he clicks them together they flash. Why do actors always wear flowers?

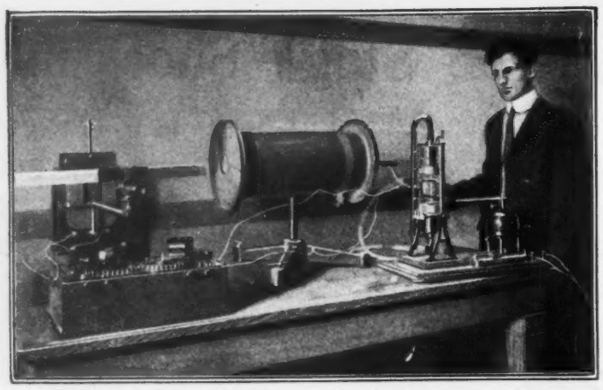



Every time one of the boxers gets a blow he sees stars—and so does everybody else present. It's not a case of sympathy, but of electricity. Both boxers wear suits and gloves that are made of interwoven metal and textile fabrics; they stand on a metal plate that is electrically charged, being connected with a battery concealed beneath the floor. Whenever they hit each other, a spark jumps from one to the other

Nearly every season Joan of Arc turns up on the theatrical stage to get burned at the stake. You know perfectly well that they can't burn an actress every night, and yet the stage burning is most realistic




Joan is tied to the stake, and the logs are piled up in front of her. Next come red electric lights, and then a real log fire. An electric blower sends the flames and smoke into the air, and it looks just as if the flames were coming from the logs at Joan's feet. Strips of colored silk are blown into the air behind her, and you are almost convinced that she is really burning



With this formidable apparatus scientists are seeking to determine the ratio between the velocity of sound and the temperature of the medium through which it passes

## How Fast Will Sound Travel in Hot Air?

THE speed with which sound travels through space depends in some measure on the temperature of the medium through which the sound waves pass. But what is the exact relation?

Professor T. R. Watson, of the University of Illinois, used in his investigations the apparatus shown in the picture, which was devised by him and his assistant, Mr. H. T. Booth. It consists essentially of three parts. At the right of the picture is a Helmholtz siren driven by a small electric motor. The pitch of the sound produced by the siren is indicated by a counter connected with the siren.

The spool-shaped apparatus supported by a stand in the middle of the picture is the resonator of the type invented by Rayleigh. It consists of two concentric metal tubes of different diameter. The smaller cylinder, which is placed inside the larger, is encircled by a heating coil. By sending an electric current through the resistance coil the inner tube may be heated to a high temperature, and the temperature may be maintained indefinitely.

The pitch of the inner tube at normal temperature is known. From the inner tube, at a point two thirds of the distance from the open end, a vertical tube of small diameter extends upward through the outer tube. Within that vertical tube a fine thread is suspended to which two small circular disks are attached—one just within the horizontal tube, at the end of the thread, the other higher up, outside of the larger tube.

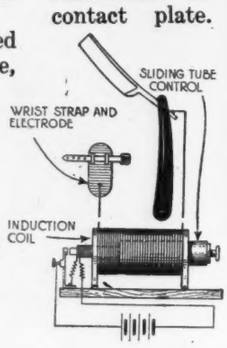
The lower disk will respond by rotating to siren sounds having approximately the same pitch as the resonator, while the higher disk will show a maximum deflection when the pitch of the siren is sufficiently raised to correspond with the pitch of the resonator at the higher temperature. By plotting the observations made at different temperatures on a chart, lines were obtained which established a fixed ratio between the square of the pitch and the absolute temperature. This ratio was maintained only for temperatures up to 400° Celsius. In the experiments the temperature of the inner tube was regulated by a thermostat.

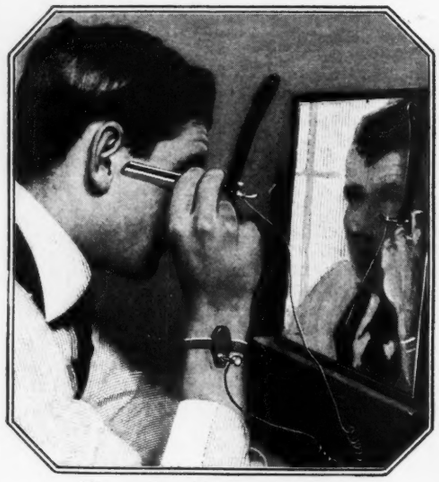
## Make Your Thin Bristles Stand Up Electrically

WHEN you wish to shave, how can you make "each particular hair to stand on end like quills upon the fretful porcupine"? By means of a faradic current, says Frank White, of Missouri; and he has invented a razor that will supply it.

Faradic current causes muscular contraction at each make and break. This muscular contraction in turn causes the hairs near by to rise up.

The blade of the razor may be of either the ordinary or the safety-razor type. The handle is insulated and has a hollow center through which the electric wire is run. It continues on, winds around an induction coil, and travels from there on to a contact plate that is strapped to the user. The primary coil of the induction coil is connected to a storage battery. Thus the user completes the circuit from razor-blade to contact plate.



The electrified razor-blade makes the bristles rise up to be cut, and massages the face

## Dance in the Footprints

"DO you dance?" "No." "Why not?" "Can't."

Such conversations are heard time and time again. "Ah, but anyone can learn to dance," says Max Rothkugel, of New York city, "if he uses my dancing chart."

The chart dissects each dance step into its individual foot movements, and matches them to the notes of the music.

The chart may be either book-sized or life-sized. If you use the life-sized one, you follow up the footprints painted on it. They are numbered consecutively, and each number corresponds with a note of music. If one foot is stationary for two beats, then the two numbers are marked on the footprint. If the step is taken on the toe, the number is marked in the toe of the footprint; similarly, if the heel is dropped, the number appears in the footprint's heel. When you swing around, a dotted line points out your path.

Dancing is not an art, but a simple mathematical problem, when taught with the help of this chart

# You Can't Tell the Real Tooth from the False

By P. Schwarzbach

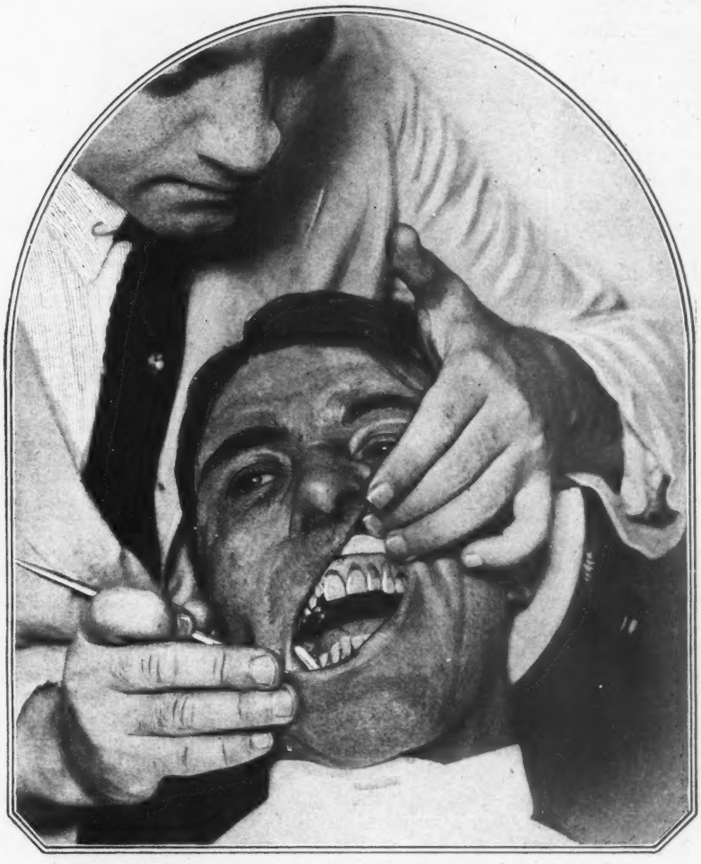
GR-R-R-R-R—the dentist tunes up his drill and grinds a great hole in your tooth. Next he hacks at it, picks at it, drills it again, and tells you to come back tomorrow for more. No wonder everybody hates the dentist!

But dentistry is progressing rapidly: pain is being eliminated, and so are the unbecoming metal fillings and gold teeth that formerly disfigured people's mouths. Dentists have found that by casting fillings and inlays as they do caps, much of the dental work now done in the mouth can be done as well out of it — but gold or some similar mineral is generally used.

Dr. F. Stanwood Welden, of Brooklyn, New York, was the first dentist successfully to combine porcelain with casting after an inexpensive method within reach of the ordinary dentist.

This porcelain is said to be the closest imitation of natural tooth structure ever produced. The peculiar textural translucency of a tooth is duplicated; gums are restored; the chemical composition of the porcelain is very like that of tooth enamel; moreover, it is stronger than tooth enamel, and will cut glass like a diamond. It is absolutely insoluble, and insulates the nerve of the tooth from shock due to heat and cold.

The porcelain comes in twenty-two different shades, including creams, grays, and pinks, so that the dentist will be able to match virtually any tooth or restore receding gums to a natural appearance. In filling a tooth, Dr. Welden, after drilling in the usual way, makes a wax impression of the cavity. From this impression he is able to make a porcelain filling that will fit the cavity exactly. He usually leaves a piece of porcelain on the outside of the casting to serve as a handle while the filling is being cemented in.



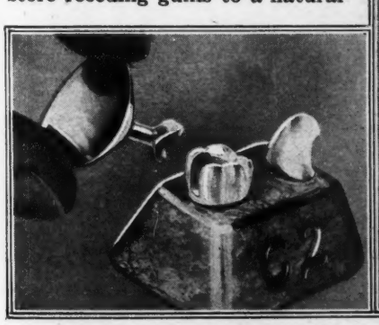
Porcelain fillings cast to fit the cavity have been placed in the patient's upper teeth when the gums have receded. The new filling can scarcely be distinguished from the tooth surface

In making porcelain inlays, the wax pattern is subjected to the proper degree of heat to consume the wax; then the molten porcelain is forced into the space formerly occupied by the wax pattern, thus making certain that the inlay will exactly fit the original cavity of which the wax pattern was taken.

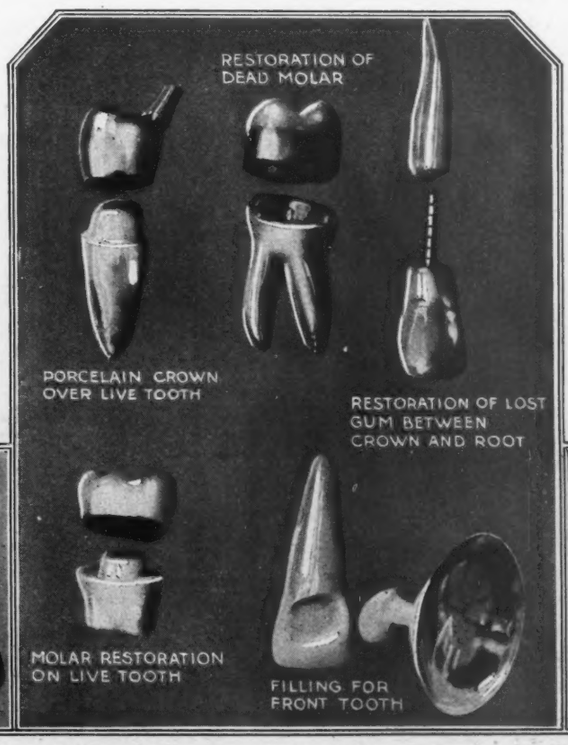
In an article about his new porcelain Dr. Welden says:

"After thousands of experiments it was discovered that the best results were obtained by alloying various silicates in proper proportions, just as metallic alloys are made. It is well known that the fusing point of any alloy is much lower than the fusing point of any of the constituents of the alloy. For instance, Rose's metal is made of lead, tin, and bismuth in the proper proportions. It fuses in boiling water, and yet any one of its ingredients fuses at a much higher temperature.

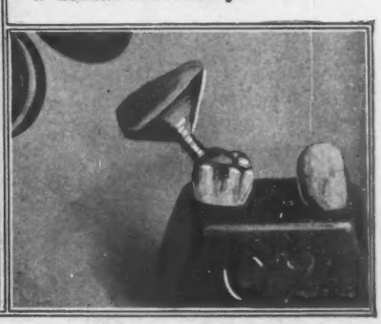
"Taking advantage of this fact, I have produced a silicate compound that fuses within the range of the ordinary gas blowpipe and is thus made amenable to the every-day procedure in a dental laboratory."



Showing (by means of a model tooth) how a porcelain inlay is applied: notice the cup-shaped handle for manipulating it


RESTORATION OF DEAD MOLAR
PORCELAIN CROWN OVER LIVE TOOTH
RESTORATION OF LOST GUM BETWEEN CROWN AND ROOT
MOLAR RESTORATION ON LIVE TOOTH
FILLING FOR FRONT TOOTH

Here are some caps, a pivot tooth, and an inlay made from the new porcelain: in color and chemical make-up it is more like real tooth enamel than any other porcelain made; and it comes in twenty-two shades

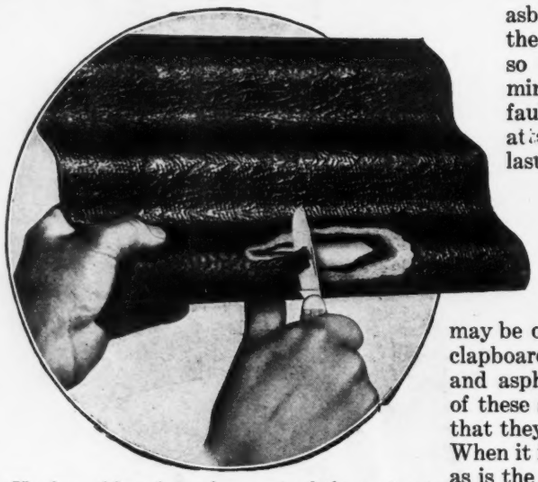


The model tooth with the filling in place. The handle can now be cut off. At the right of the picture is the finished tooth

# You Need Not Have Leaky Roofs

WHY does the owner of the hands in the picture persist in chipping pieces from a brand-new strip of roofing? He's not destructive — just demonstrative; he chips in order to show you the four layers that make up this new waterproof, corrosion-proof material. The inside layer is steel; next comes asphalt; then asbestos, and on top of all waterproofing. What chance do water, smoke, gases, and fumes stand of destroying a roof made of such stuff?

The roofing is made in the following manner. A steel sheet is heated to a certain temperature and then cleansed of grease, moisture, and destructive oxides. The steel is next given an asphalt bath. It comes out with a coat of thick, elastic asphalt that will protect perfectly — as long as the asphalt is intact. But asphalt is susceptible to light and heat. Hence the next layer of asbestos felt. This is forced into the asphalt by pressure and heat, so that the two become intermingled. But asbestos has its faults, too. It softens when water attacks it. And so we have the last and outside layer of waterproofing. The roofing is then ready to defy the destructive elements.



He has chipped a piece out of the waterproof roofing to show its four layers of steel, asphalt, asbestos, and water-proofing

It is used for ventilators, siding, skylights, and gutters as well. Used as roofing, it may be obtained in corrugated, beaded, clapboard, or flat sheets. The asbestos and asphalt are drawn over the edges of these sheets when they are made, so that they too are thoroughly protected. When it is necessary to cut these sheets, as is the case in manufacturing ventilators and skylights, the raw edges are treated before they are sent out.

# The Perfect Cartridge—How It Gets That Way

DO you pride yourself on your ability to shoot, and do you carefully polish the sharpshooting medals you have won? Then think of the perfect cartridges that made your record shots possible. In order to perfect cartridges the manufacturers must carry on an extensive amount of very careful testing. In one plant twenty-five million test shots are fired every year; and the record is about one subnormal cartridge in every six thousand.

In one of the tests the cartridges are fired into a large sand-bank. Every hour men go through the plant and take samples at random of all kinds of ammunition.

Then again, there is the test for determining bullet velocity. For this a fine wire is drawn across the muzzle of the gun and this wire is connected with an electrical attachment holding a long rod. When the bullet leaves the gun's muzzle it breaks the wire and releases the rod.

When the bullet reaches the target, another connection is broken, releasing a weight. This falling weight operates a lever, which in turn makes a scratch on the falling rod. Thus the distance between the zero mark on the rod and the place where the rod was scratched represents the distance the rod fell.

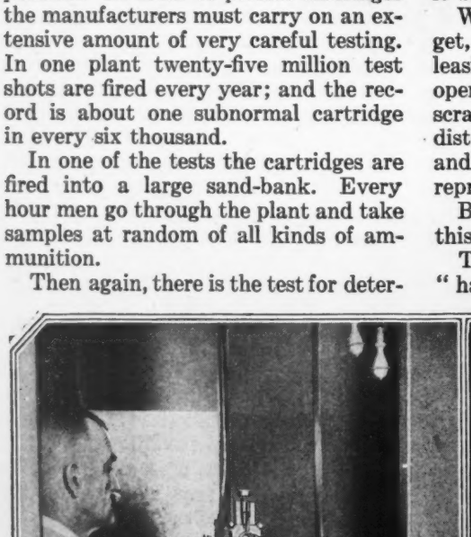
Bodies fall at a definite rate; hence this fall can be translated into time.

Then, there is the question of "hang-fire" — by which is meant the delay of the cartridge in exploding after the hammer strikes the primer. This delay may be as long as half a minute.

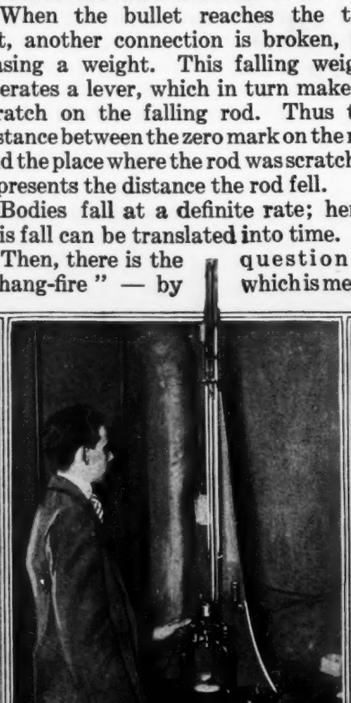
Hang-fire is tested just as bullet velocity is tested — the rod being released when the firing-pin strikes the primer. The weight is released when the shot leaves the muzzle of the gun.

Primers are tested both for certainty of fire and for over-sensitiveness. There is a test for making sure that shells and cartridges are accurately loaded, tests for recoil, and others for the velocity of the shot after leaving the barrel.

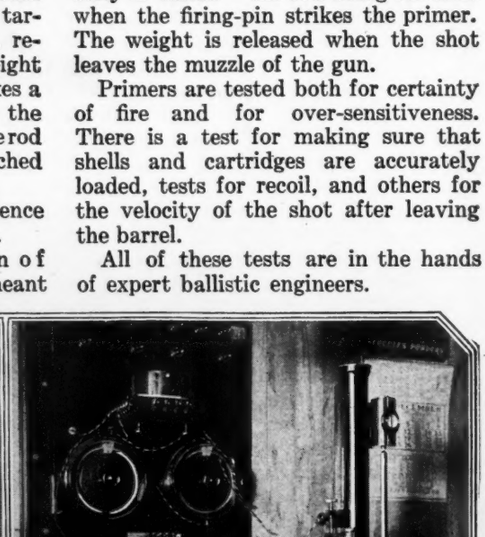
All of these tests are in the hands of expert ballistic engineers.



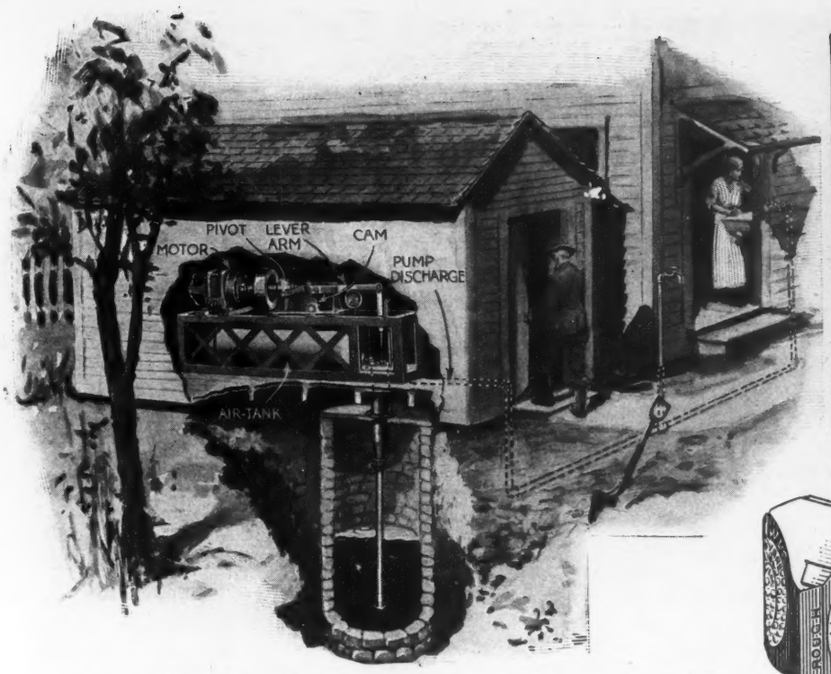
To test the breech pressure of a cartridge, the rear end of the barrel is drilled and a piston is inserted; on exploding the piston shoots upward and the cylinder is compressed; the length before and after this operation indicates the compression



By measuring the blow of a weight dropped on a primer it is possible to determine the force necessary to explode it



How long does the bullet take to reach the target? This chronograph answers the question. The breaking of a wire by the bullet as it leaves the rifle starts the chronograph registering, while the impact on the target breaks the electric circuit and completes the record




A pump that will bring water from your well to your kitchen; it sucks the water into a tank connected by pipes to the kitchen faucets

Practise golf indoors by using a small cardboard "ball"; hitting the inside circle equals a 200-yard drive

## From Well to Kitchen Sink

"JACK and Jill went up the hill to fetch a pail of water"—you are familiar with the tragedy that followed. It might never have happened if an automatic electric pump like the one shown above had been attached to the well. You see, they would not have had to go up the hill, but could have gone to the faucet in the kitchen for their pail of water.

The pump, which is located above the well, sucks up the water through a pipe extending down into the well. The water is drawn into a small tank attached to the base of the pump. Pipes lead from the tank to faucets in the house. The object of the tank is to prevent the jerky flow of water from the faucet that would result if it were pumped directly from the well. The tank being a small one, the water in it will not become warm or stagnant, as often happens to water held in large tanks.

Still another job is assigned to the tank: it works the switch that starts and stops the motor. When the water in the tank is low, a diaphragm pressure switch attached to it starts the motor turning and the pump pumping. When the tank is full, the motor stops.

## Indoor Golf

GOLFERS may practise their strokes indoors in the winter by substituting for the regular ball a recently invented cardboard golf-ball. The cardboard ball is not a ball at all, since it is shaped like a triangular prism. On each of two sides of the prism is a white spot having a circumference like that of a regular golf-ball. Two black circles are drawn on each white spot, the inside one being marked "200 yards," the outside one "100 yards."

Pointed wire attached to the golf-stick impales the "ball" when it is hit, and an inspection tells how far the shot would have carried on the golf course.

## The Old Rag Doll Has Now Turned to Seaweed

SEAWEED—what's it good for? The only thing most of us do with it is snap the blister to hear it "pop."

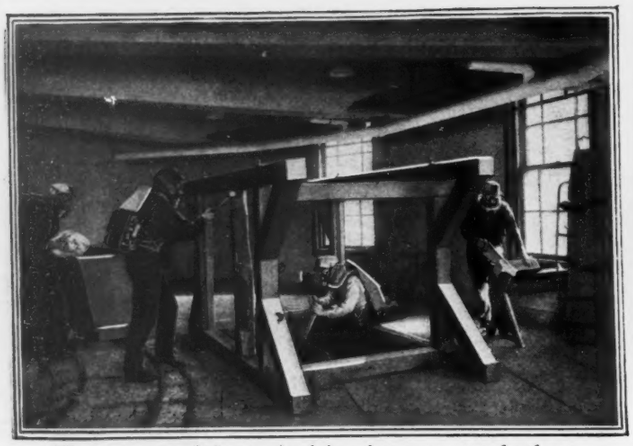
But seaweed has a real commercial value. It may be turned into a hard, tough substance and used for making ash-trays, baskets, and even dolls.

As we know, seaweed in its natural state is wet and rubbery. In order to make it hard and tough it must be chemically cured so that most of the vegetable matter is eliminated. Then, just before it dries it is cut and twisted into any shape that may be desired.

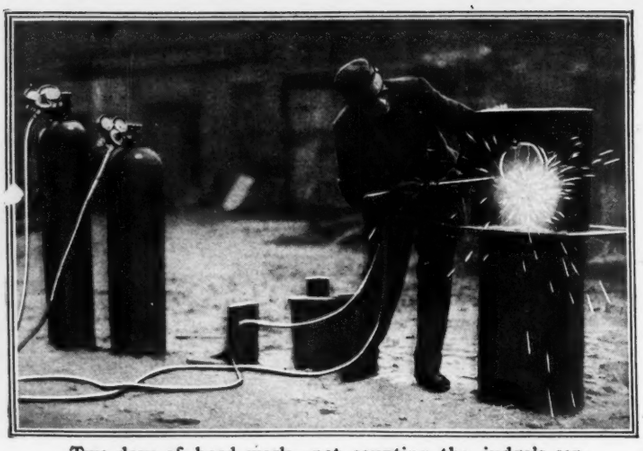
Nature has colored the outside of the stems of the seaweed a rich reddish-brown color and the inside a soft cream shade. No artificial coloring is necessary, therefore, in order to make the various articles shaped from the seaweed attractive to the eye.

The kind of seaweed known as "kelp" is most often used; its scientific name is *Macrocystis pyrifera*. It has the distinction of being the longest plant in the world, for it sometimes reaches a height of fifteen hundred feet. Recently chemists have found that seaweed contains a small amount of the much needed potash; and now strange boat mowers are seen along the coast—harvesting the much desired kelp.

These trinkets come from the bottom of the sea—not in their present form, to be sure. Most of the vegetable matter is taken out of the seaweed by a chemical process, and the remainder is cut and shaped into various forms and dried



These men are being trained in mine rescue work; they wear gas-masks because the room is filled with poisonous gas. The masks are self-sufficient, needing no air pipes



Two days of hard work—not counting the judge's sentence—are ahead of the burglar who tries to cut through a recently invented metal that defies the oxyacetylene flame

# Rescue Squads at School

HOW long have sawing, hammering, and chopping wood been deadly deeds? You will naturally ask that question when you notice that all the woodmen in the picture above wear gas-masks.

The reason for the masks is that the room is filled with formaldehyde gas. It is the testing gallery of the Mine Safety Section of the Bureau of Mines at Pittsburgh. The men—students in mine rescue work—are wearing a new kind of gas-mask that makes its own oxygen and needs no outside pipe-line.

The amount of oxygen that is generated depends entirely on the amount of exercise done by the wearer. That is one reason why the men are making the wooden frame alongside of the tracks. The other reason is that they need practice in the kind of work they may be called on to do, and wooden props like the one shown in the picture must often be set up in coal-mines. A mask of this type will supply a man with enough oxygen for two, three, or even ten hours, depending on the amount of exercise he is taking.

The testing gallery is an airtight room, semicircular in shape, and having an area of more than sixteen hundred square feet. In it there is a forty-five-pound weight-pulling machine, a wall over which students climb carrying props, and a place for the building of brick mine stoppings.

The picture shows a man loading a mine car with sacks of rock; when it is loaded he will push it one hundred feet along the track and unload it. The man who is sawing thin blocks of wood from a log is using a dull saw which makes his work difficult and tedious. Behind him is a bicycle having a friction brake. The men must ride this while wearing their masks—a most trying task, as may readily be imagined.

Men in training for mine rescue work receive a five-day course in which they are taught the construction, principles, and care of their masks, and they must wear the masks for five two-hour periods; during four of these periods the testing gallery is filled with poisonous gases.

Naturally, only men in the pink of physical condition can stand the strain of this arduous training in rescue work, which also calls for courage and resourcefulness of a high order.

# Making Doors for Hades?

FOR many years steel-plated safes and vaults gave ample protection against the predatory knights of the jimmy. Then the invention of nitroglycerine gave the criminal element the advantage for a while, until science taught how to make steel so hard as to defy the cracksman's drill. The balance again tilted in favor of the evil-doers when science gave to the world the oxyacetylene flame, which eats its way through steel as a hot knife does through butter. But once more science spoiled the cracksman's game, by producing a metal that is proof against even that.

The new metal, which resists the oxyacetylene flame to a remarkable degree, had been in use for some time for door-sills, stair-treads, floors, vault lights, and coal-hole covers before its refractory qualities were discovered. The layer of abrasive, a metallic carbon compound harder than the hardest steel and almost indestructible, which is embedded in the surface of steel plates or bars, not only resists wear by the polishing effect of sole-leather, but affords protection against the drill and the oxyacetylene torch of the safe-blower.

After exhaustive tests it is estimated that it would take two men fully two days' work with about forty tanks of oxygen and ten of acetylene to cut a hole in this metal large enough to permit a man to crawl through.

A small shower attached to the faucet will give the dirty workman all the benefits of a real shower bath. He soaps himself, then turns on the shower and washes the soap off thoroughly

## Showers Make the Skin Grow Cleaner

SHOWERS—not the kind that come from the sky, but from the water faucet—furnish the most thorough kind of bath. The force of the water beating on the body thoroughly cleanses the skin.

Believing this, a large steel company recently decided to install small shower attachments on all the wash-basins throughout its plant. In the picture at the left one of the workmen is shown taking his shower after a dirty day's work.

You may think that his face still looks dirty; it isn't: he merely needs a shave.

By stripping to the waist, soaping his arms, neck, and face, and then washing off the soap in the strong flow of the shower, he has turned out much cleaner than he would have if he had washed in the basin in the ordinary manner.

# "It Can't Be Done"

## How steam came to be used to shoot concrete into place

By Harold P. Brown

"LOOK at this," said the manager of an electric railway company in Easton, Pa., to me one day in the spring of 1911.

He pointed to the reenforced concrete columns, girders, and beams of a large packing-house. From cellar to garret, wide cracks followed the lines of the buried steel.

Near the packing-house was a railway power plant, and the packers thought this was the source of the trouble. But with suitable electrical instruments I demonstrated beyond a doubt that it was caused by electricity that had leaked from the circuits of the packing-house.

"Can you put the building into a safe condition electrically and repair the damaged concrete?" the packers asked me.

As an electrical engineer I felt I could solve the first problem. But I knew nothing about concrete. Experts assured me that the repairs could be made with a machine that blew a stream of dry cement and dry sand into a jet of water. In accordance with their advice, I undertook the contract of repairing the concrete after installing the electrical protective apparatus.

The cement-shooting machine worked well enough, but some of the fine, dry cement that escaped from the cone of the water-jet rained down upon everything within a radius of eighty feet.

"You will ruin our meat," said the packers. The government inspectors agreed with them, and told me to stop.

What was I to do? After a search I found a machine for which it was claimed that it would blow a wet mixture of cement and sand and make it stick. I tried the apparatus. It failed ignominiously, and I sent for the inventor. After spending several miserable hours in the dripping wet cooling-room of the packing-house, he delivered himself thus:

"Any man who tries to place new concrete on the lower edge of an old concrete beam is a fool. But any man who tries to do this in a room where the temperature is below freezing is crazy. It can't be done!"

But I had meanwhile been using pneumatic hammers to chip away cracked concrete four inches thick on three thousand lineal feet of beams and girders. All the lower reenforcing rods of that concrete were exposed to salt water. The building seemed doomed; also my professional reputation. I decided that I would have to design my own apparatus.

With a motor, frame, and hopper I built up a crude device that worked fairly well with compressed air. A few tests showed that the jetted concrete would hold. But why not heat the air? I made the attempt. The results were excellent in rooms where the temperature was below freezing. Engineers all over the country became interested in the work. I received orders for similar machines.

In two weeks I had the first concrete atomizer. Two machines were built and sold at once. Since that time I have repaired the honeycombed structure of the Lackawanna Railway Terminal at Hoboken, patched the first concrete barge built in this country after it proved to be too badly honeycombed for service, and kept myself busy shooting concrete.

At first I used compressed air. Later I became convinced that steam would give better results at less cost.

"It can't be done," said the engineers once more. "The cold concrete will condense the steam."

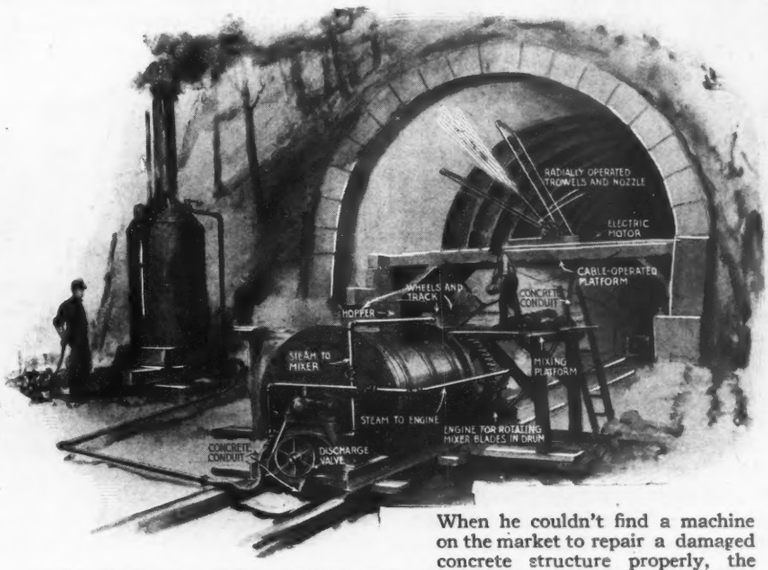
I obtained the use of a railway switch engine for my steam plant. In order to superheat the steam and control its temperature I arranged a coil of pipe in a coke fire. From seven in the morning we worked all one June day, without stopping to eat. No success.

At five o'clock I mixed a final load of one part cement, three of sand, and two of fine pebbles with about fifteen per cent of water and with steam at 300° F. A perfect stream shot out, spread evenly, and adhered to the steel-work it was to cover. The next morning there was a flintlike surface better and stronger than the air-jetted concrete around it.

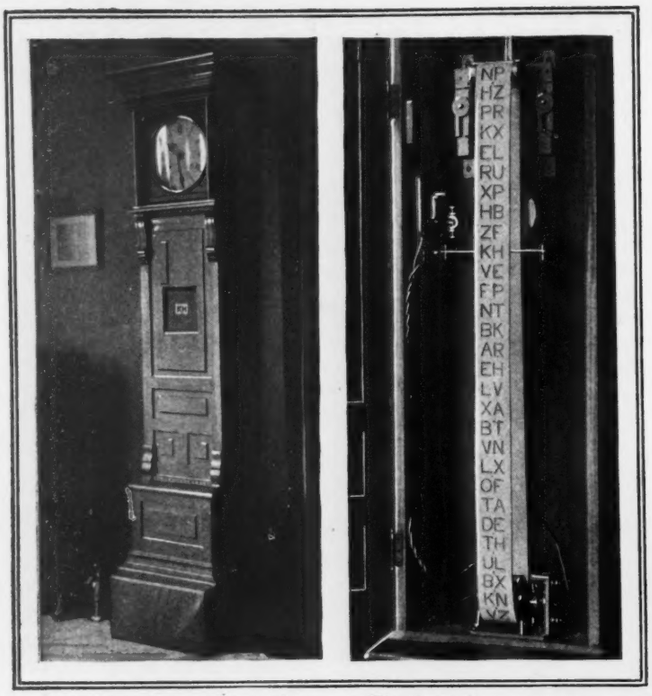
That was the beginning of much railway concrete work. When I was asked by the Chicago and Great Western Railway to reline its tunnel at Winston, Ill., I tackled my most difficult job. Over the track center, nearly the entire lower course of brick had been worn away by the combined action of the locomotive exhaust and of streams of water that seeped through under heavy pressure. Since it is physically impossible for a man to hold a two-and-one-half-inch nozzle shooting a stream of hot concrete directly over his head, I designed and placed on a flat-car a motor-driven rock-shaft located at the arch center, to which a flexible nozzle-holder was attached. This was mounted on a carriage, so as to be moved ten feet forward and backward by means of a hand winch, and it also swung to and fro a spring-trowel device. This invention did away with hand mason work in finishing the surface. An adjoining flat-car carried the atomizer and necessary materials. A box-car at the far end of the train supported the scaffold required for the work of removing defective brick.

I have since worked out a modification of the nozzle car and trowel machine for making concrete roads with an upper surface that will wear as well as granite.

Thus what seemed an overwhelming failure resulted in the invention of a new labor-saving apparatus, new building materials, and new methods of construction.




When he couldn't find a machine on the market to repair a damaged concrete structure properly, the author made one. "My most difficult job," he says, "was relining a tunnel on the Chicago and Great Western Railway. For this under-taking I placed a sprayer on a flat-car which was moved to and fro by means of a hand winch




In the center of the clock there are the letters KH, which the workman writes on his time-sheet instead of the hour and minute

The letters are on a revolving belt; the workman not knowing their order, there is no chance of dishonest registering

## Every Minute Is Lettered

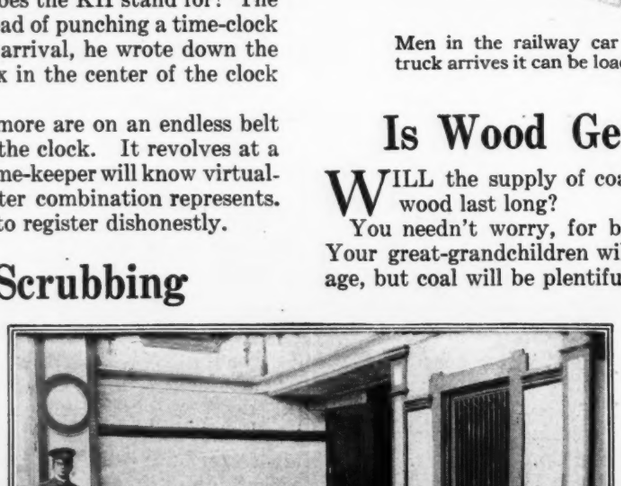
"KH—Smith—9" looks mysterious, doesn't it? It might easily be an important message in code, but as a matter of fact it is no more than a workman's time record. Smith is the man's name; 9 stands for the number of minutes he was late. What does the KH stand for? The time at which he arrived. Instead of punching a time-clock or recording the actual time of arrival, he wrote down the two code letters he saw in a box in the center of the clock panel.

These two letters and many more are on an endless belt that is operated electrically by the clock. It revolves at a fixed rate of speed, so that the time-keeper will know virtually the exact time that each letter combination represents. It is impossible for a workman to register dishonestly.

## Too Much Scrubbing

WHILE they crowded into the entrance of a moving-picture show in Cincinnati awaiting their turn to attend the second performance, fifty-four people were suddenly dropped fifteen feet into the basement of the theater when the flooring upon which they stood gave way. Out of the fifty-four people who went down, more than thirty were severely injured.

After the accident it was found that the timbers supporting the floor had been in a bad state of decay. The novel theory advanced by officials was that the flooring and its supporting timbers were kept in a continually damp and moldy condition by too frequent scrubbing of the floor!



The wooden floor in the lobby of a moving-picture theater was scrubbed too often and the wood rotted; the result was that under extraordinary strain it suddenly gave way

## It Saves the Motor-Truck's Time

NO longer can the motor-truck driver sit idly on the seat and smoke cigarettes while men in the railway car behind him shovel on his load. The men will simply pull a lever, and down will come the sand or gravel or coal out of a metal bin, or "loader skip," attached to the side of the car. Then the driver will be invited to "put her in high" and move on. His truck will be idle for only a moment or two.

A contrivance such as this means much saving in time. Time is money in motor-truck operation, because interest on the considerable amount of capital invested in a truck, depreciation, and other overhead charges run on just the same, whether the truck is in operation or not. This new loader skip can readily be attached to the side of a car, because it comes in six parts, easily moved about in the yard by a man or two, and lifted into position. Two sizes are made—of one cubic yard and of one and a half cubic yards capacity respectively.

Men in the railway car fill the "skip," and when the truck arrives it can be loaded without the slightest delay

## Is Wood Getting Scarce?

WILL the supply of coal give out? Will the supply of wood last long?

You needn't worry, for both of them will outlive you. Your great-grandchildren will begin to feel the wood shortage, but coal will be plentiful for several hundred years.

The National Lumber Manufacturers' Association has estimated that there is enough standing timber in the country to supply the lumber industry with raw material for at least one hundred and fifty years. This estimate includes the continual growth of new trees at the annual rate of twenty billion feet.

In spite of the fact that the excess of exports over imports each year may somewhat increase the annual drain, the total domestic consumption is not expected to exceed the usual amount, which is approximately thirty-three billion feet each year. You can see why the lumber manufacturers were sufficiently interested to compile these figures.

# What Can You Do with an Electric Fan?

## The Popular Science Monthly offers three prizes for new uses for it

OF course you use an electric fan to keep cool. But look at these pictures. Here is a method of using an electric fan to keep warm! The fan may be used to increase the draft of the cellar furnace; or it may be used to blow the hot air rising from a steam radiator into the room. We know of an enterprising Italian who keeps flies away from his fruit by means of an electric fan; of storekeepers who prevent their windows from being coated with ice by means of the electric fan.

There must be many more uses for the electric fan. We want to know about them. Tell us! The POPULAR SCIENCE MONTHLY offers three prizes—a first prize of $25, a second prize of $15, and a third prize of $10, to be awarded in accordance with the following rules.

### *Rules Governing the Contest*

1. Submit as many methods of utilizing the electric fan as you please. But remember that only one method can possibly win the first prize, only one the second, and only one the third.

2. The method of using the electric fan should be shown either in a photograph or in a drawing. We prefer photographs, and above all photographs in which a human being is shown doing something useful. If a drawing is sent in, it need not be made by a skilled draftsman, as long as it is intelligible. Pencil sketches will be considered; but drawings made with ink on Bristol board are better. Write your name and address on each sheet of drawings and on the back of each photograph.

3. Your pictures should be accompanied by a description, preferably typewritten, in which you tell us of your method of using an electric fan. Write on one side of the paper only, and confine yourself to 500 words. Your name and address should appear in the upper left-hand corner of the first sheet of the written description.

4. The drawings, pictures, and descriptions entered should be received by the POPULAR SCIENCE MONTHLY not later than 5 p. m. on January 30, 1920.

5. The judges of the contest will be the editors of the POPULAR SCIENCE MONTHLY.

6. The first prize of $25 will be awarded to the contestant who, in the opinion of the judges, suggests the most striking, unfamiliar, and practical method of utilizing an electric fan for a purpose other than that of cooling a room.

The second prize of $15 will be awarded to the contestant who submits a method next in merit.

The third prize of $10 will be paid to the contestant who submits the method third in merit.

Don't tell us of methods that have already been published.

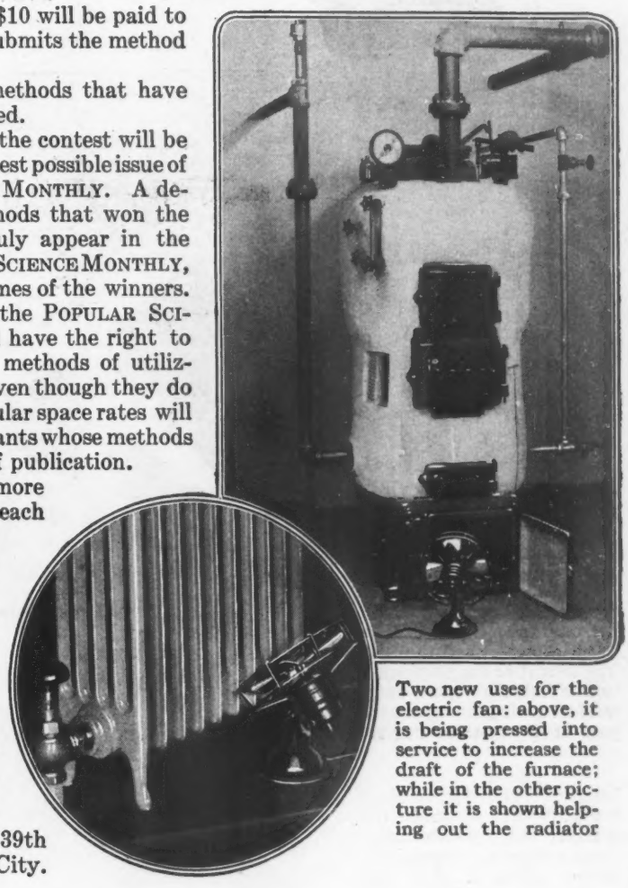
7. The winners of the contest will be announced in the earliest possible issue of the POPULAR SCIENCE MONTHLY. A description of the methods that won the prizes offered will duly appear in the pages of the POPULAR SCIENCE MONTHLY, together with the names of the winners.

8. The editors of the POPULAR SCIENCE MONTHLY shall have the right to publish meritorious methods of utilizing the electric fan, even though they do not win a prize. Regular space rates will be paid to the contestants whose methods are deemed worthy of publication.

9. If you submit more than one method, each description and picture should be sent as a separate unit.

10. No manuscripts or drawings will be returned.

11. Address pictures and descriptions to the Electric Fan Contest Editor, POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York City.



Two new uses for the electric fan: above, it is being pressed into service to increase the draft of the furnace; while in the other picture it is shown helping out the radiator

# Making Climate to Order at Home

WHICH is your favorite climate? Do you like the moist and salt-laden air of the seashore or do you prefer the dry and thin air of the mountains?

What useless questions, you may think, when you can neither control the climate in which you live nor travel to another. Yet there is no reason why you should not enjoy in your home the climate you like, provided you can afford to pay the cost.

With a suitable heating plant you can regulate the temperature of your home to tropical conditions even in midwinter. If you prefer a frigid temperature you may have it by installing a refrigerating plant. If you like the air dry, remove the moisture contained in the air by conducting it through tubes filled with calcium chloride or some other desiccating substance. If you like it moist, charge it with steam or water in the form of a fine spray. Mountain conditions may be produced by making your house airtight and reducing the air-pressure.

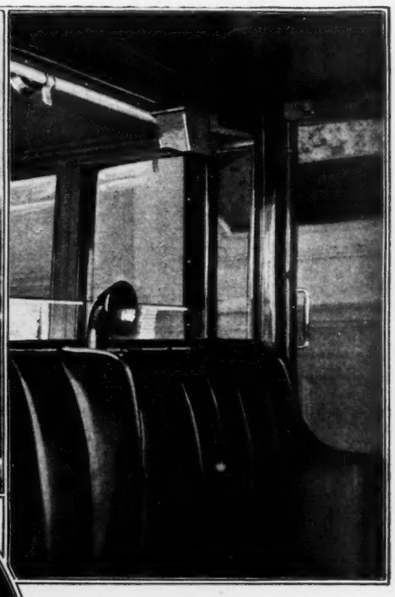
To make sure that the air is free from dust install an apparatus like that in the picture. By means of an electrically driven suction fan the air coming from outside is forced through a reservoir containing water. If you wish you may put a few drops of your favorite perfume, of a disinfectant, or of an essence of pine needles in the water.

With this apparatus you may change the air in your room so that it will be of the purity and fragrance of the air in the pine woods or mountain meadows

# Helping the Motorist to Save

## New things that play important parts in making

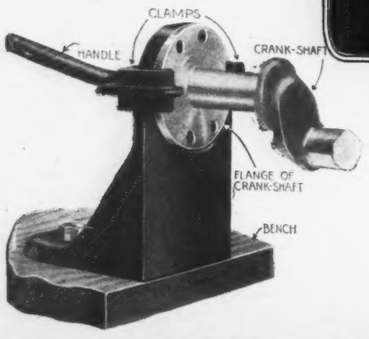
Many rear driven trucks have attempted this incline, but only the four-wheel drive truck accomplished the feat. The height of the platform is twelve feet, the slope twenty-one feet, giving an angle at the base of thirty-three degrees



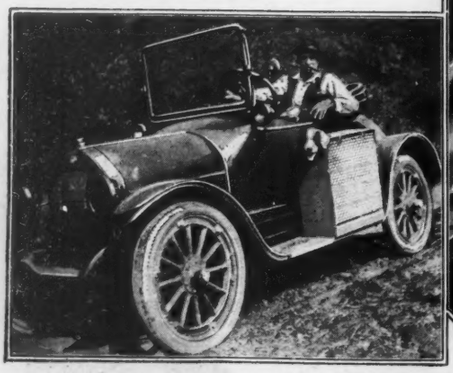
The periscope at the top of the picture, in cooperation with a mirror on the steering-post, tells the chauffeur all he needs to know. The detective owner refuses to tell his method of eyebrow lifting

A new garage accounting system permits its owner to realize fully on his credit service, and, in addition, to handle all charge transactions—make the original entry, and post and balance the account, with a statement to date for the customer—at one writing

Instead of holding a Ford crank-shaft in a vise in the ordinary way, which sometimes springs the flange, this device gives a flat, full bearing surface with a quick operating handle clamp




An electric contact point slipped over the driver's forefinger is operated from the tonneau. One shock means "Home"; two "The office"



A motorist constructed this structure on the running-board of his car, for the purpose of carrying his hunting dog with him on his trips

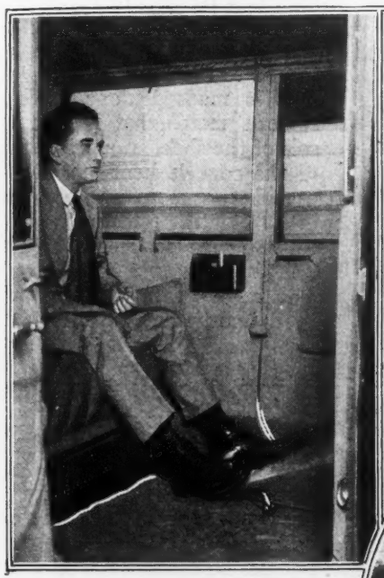
Operated in total darkness if necessary, the steering-post lock clamps the driving wheels in a straight line by a combination

An electrically connected stop-watch operates another on the instrument-board. When madame stops the watch it reminds the chauffeur of an engagement

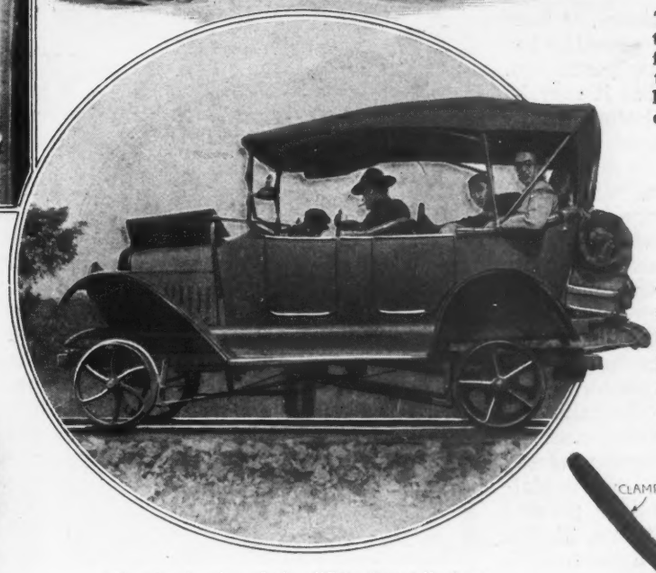
# His Hard-Earned Money

## the automobile and truck efficient

This huge truck body, twenty feet long and eight feet high, permits the truck to carry a full freight-car load of furniture on either long or short runs



A cut-out pedal connected in the tonneau is a good way to signal one's chauffeur. Engine noises mean a lot to any driver, and a code can be easily arranged



On the banks of the "Big Ditch" there are no automobile roads. By attaching railroad-car wheels to their machine the army officers shown in the picture above were able to make an inspection of the Canal by riding comfortably over the rails

If your car has overhead valves, the clicking noise can be eliminated by these spring silencers. They take up the play and hold the cam rollers snugly against the cam-shaft

The base of the crank-shaft holder may be turned into a convenient device for relining Ford brakebands by the addition of the upper curved casting inserted in place of the crank-shaft flange

By means of a small lamp on the windshield, this chauffeur receives his instructions in electric light flashes

Before taking a certain sharp corner in California at high speed, fast drivers are discouraged by this remarkably suggestive sign

Help to keep the interior of your car clean by a wire mat which comes ready to attach to the running-board

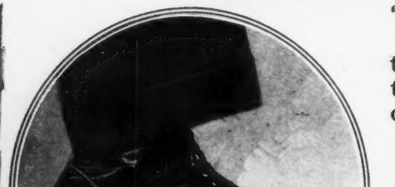
A truck like this will save many a minute and, consequently, many a dollar in a busy factory

## A Time-Saving Truck

THE ordinary two-, three-, or four-wheeled truck was displaced by the lift-truck invented a few years ago. This is so constructed that it may be pushed under a suitable platform loaded with goods. After the truck is placed in position its platform is raised by a lever or a worm gear until it has lifted the loaded platform off the ground or floor. Then, with its load of goods, it is wheeled to its destination, and its platform is lowered until the supports of the platform rest on the ground.

The lift-truck shown in the accompanying picture is of extremely simple construction. When its platform is in position under the load, the handle of the truck, which is pivoted near its lower end, is used as a lever to raise and pull forward the front end of the platform. Diagonally placed links, pivoted to the platform and its frame, lift the rear end of the platform if the front is lifted and brought forward. A catch holds the platform in position.

## Metal Overshoes for Sliding



The high price of shoes threatened annihilation to the sliding-pond—but now comes a metal sliding overshoe

"DON'T let me catch you on that sliding pond!" says the mother of today—thinking of the high price of shoes. How can one slide economically? George Bascomb Weldon, of Pittsburgh, has solved the problem by inventing a "slider," to be attached to the shoe.

It is made in one piece of smooth metal that fits on the sole of the shoe. A small section of the edge is bent up at the toe, and two more at the sides, so that it will remain in place when attached to the shoe. It is attached by heavy cord that is run through five loopholes, criss-crossed, and tied at the ankle.

## How Old Are You, Egg?

An electric light at the other end of the tube shows the condition of the egg

WHAT is so rare as a rotten egg? Yet not so many years ago you were constantly breaking into one. Perhaps the reason is that poultrymen now have ways for testing eggs in order to determine their age. Most of these methods must be carried out in a dark room. The instrument shown here eliminates even that necessity. It was invented by Jesse R. Grant, of Kokomo, Ind.

First, there is a short, elliptical tube, shaped at one end to fit your face and having at the other end a small opening into which you thrust the small end of the egg. The tube is lined with light-absorbing material, so that when you fit your face to the tube all will be black. Then you turn on a brilliant electric light just behind the egg, and you will be able to see right through it. Thus you can judge the age and condition of the egg in your hand.

## There Is Nothing New Under the Sun

TAKE heart! About sixty years ago prohibition and eight-cent carfares went into effect in New York State; they lasted only a very short time!

William A. Darling, grandson of a one-time president of the Third Avenue Railroad, unearthed two mementos of those dark days. One is a medallion that some gleeful "dry" created in honor of the prohibition law. It has on one side a wreath (funeral wreath?) and the words: "To commemorate the passage of the prohibitory liquor law." The other side pictures a blazing sun, an upturned wine-glass, and the daring words, "No Repeal." The law was declared unconstitutional within a year of its passage.

The other memento is a three-cent transfer made of pewter and in size and shape resembling a half dollar. One side says "Yorkville" and the other shows a picture of the horse-car that carried you there.

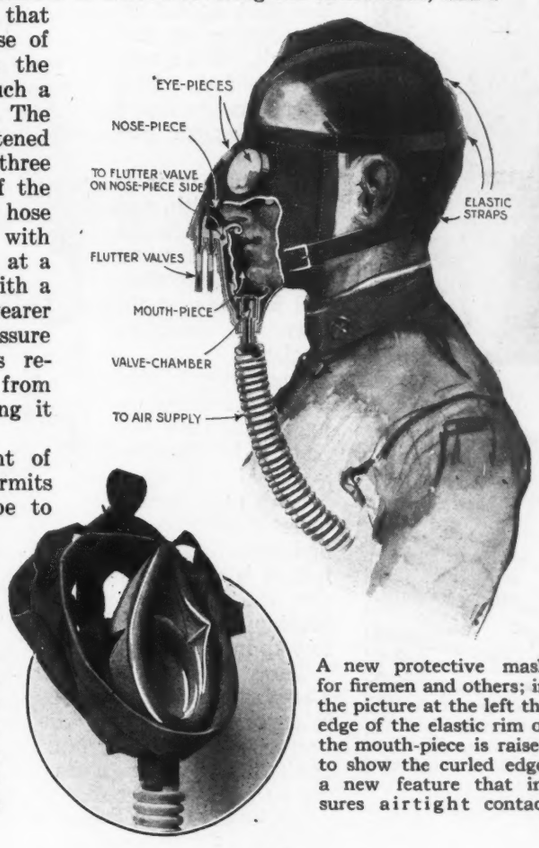
New Yorkers do not like paying two cents every time they want a street-car transfer. Their grandfathers paid for transfers, too; but they received pewter ones

Once before prohibition invaded New York, and some joyful "dry" created this medallion in honor of the occasion. At that time prohibition lasted just nine months

# Protecting the Fire-Fighters

A PROTECTIVE mask for the fireman, the miner, or the soldier in the trenches has recently been placed in the market. The mask, of rubber and rubber-coated fabric, consists of a hood covering the entire face, and a muzzle-shaped rubber cup that covers the mouth and nose of the wearer, fitting against the nose, cheek, and chin in such a manner as to be airtight. The double mask is securely fastened to the head by a harness of three straps. The mouth-piece of the mask is connected by a hose entering at its lower end with an air-pump, which may be at a considerable distance; or with a reservoir on the back of the wearer which contains air under pressure and a purifying apparatus removing the carbon dioxide from the exhaled air and making it fit to be breathed again.

An ingenious arrangement of flutter and check valves permits fresh air from the air-tube to enter the mouth and nose-piece, but prevents the unbreathable air surrounding the wearer from reaching the interior of the mask. Airtight contact with the skin of the wearer is safeguarded by the elastic rim of the mouth and nose-piece, which is curled inwardly, forming a pneumatic cushion between the skin and the mask.




A new protective mask for firemen and others; in the picture at the left the edge of the elastic rim of the mouth-piece is raised to show the curled edge, a new feature that insures airtight contact

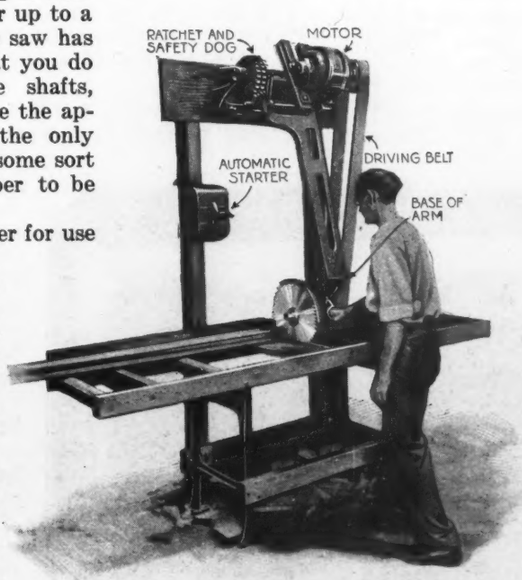
# The Circular Saw that Swings

HE presses a button, grasps a handle, pulls it back and forward—and the new, simple sawing-machine is in action, cutting off blocks of wood. It will swing from any overhead post or beam and thus takes up very little floor space.

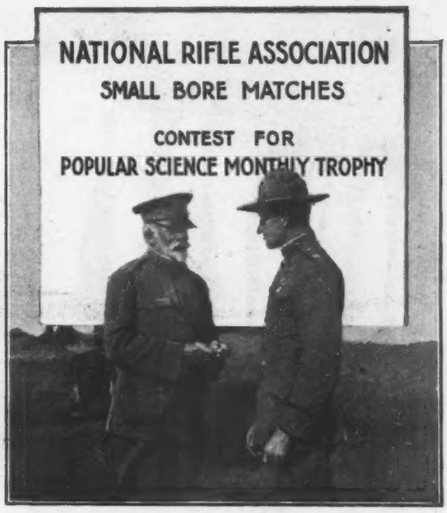
It is designed particularly for firms with a large amount of crating or boxing to do, and will cut lumber up to a thickness of two inches. The saw has its own electric motor, so that you do not have to think of line shafts, counter-shafts, or belts. Since the apparatus is hung overhead, the only floor equipment necessary is some sort of bench on which the lumber to be cut may be laid.

There is an automatic starter for use when run on direct current. The electric motor may be adjusted on a sliding base attached to a horizontal shaft. The circular saw is carried at the lower end of a swinging arm, the upper end being pivoted to the same shaft on which the motor is mounted.

The saw is driven by a belt running from one end of the motor shaft to the saw shaft. The motor is so placed that its weight overbalances that of the saw, causing it to swing to the rear of the cutting-table when released.




A motor on the upper shaft, which is belted to the lower shaft, turns the circular saw as it swings easily through the wood




Receiving the prize offered by the Popular Science Monthly to the winner in the Small-Bore Tournament

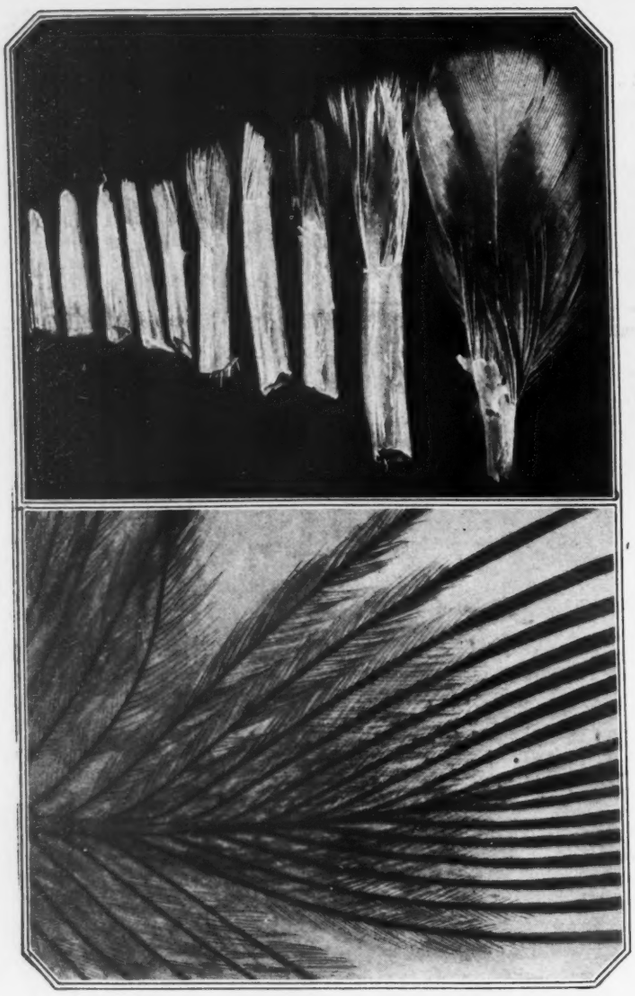
## He Won the Popular Science Monthly Trophy

THE pleased looking young man in the picture above is Captain Grosvenor L. Wotkyns, of the Ordnance Department of the Army, in civil life a Pasadena, Cal., rifleman. He is receiving the POPULAR SCIENCE MONTHLY Trophy, which he won in the National Rifle Association Small-Bore Tournament at Caldwell, N. J., last August. Colonel William Libbey, president of the Association, is presenting the trophy. Captain Wotkyns scored 392 out of a possible 400 points in the Small-Bore National Individual Match, in which the POPULAR SCIENCE MONTHLY Trophy was first prize.

His score means that at 50 and 100 yards, 20 shots per range, Captain Wotkyns averaged 98 out of the possible 100 points for each string of ten shots.

In the International Small-Bore Team Match, the United States against England, twenty men per team, with the course of fire the same as that in the Small-Bore National Individual Match, Captain Wotkyns was again high man, with the score of 391. Neither of his scores was equaled during the entire tournament, although the shooters comprised the oldest and most skilled riflemen of the country, including three picked United States Navy riflemen, several United States Marines, many Army sharks, and the best of the civilian military riflemen of the country. The American team, by the way, won from England by 94 points.

The POPULAR SCIENCE MONTHLY Trophy, a handsome watch costing $150, was the most sought prize of the large prize list at the small-bore tournament. Captain Wotkyns' victory was a popular one, inasmuch as he was the builder of the small-bore range and assistant to the officer in charge.



Skin produces claws, nails, hair, and feathers. The top picture shows a sparrow's feathers unfolding from the quill; the lower picture shows the tip of a feather

## Things that Grow Out of an Animal's Skin

THE skin is not merely a covering for animals. It is an essential part of the organism. It produces claws, talons, nails, the rattlesnake's rattles, spurs, hair, the scales of fishes and reptiles, spines, whalebone, beaks, and feathers. So claims Mr. Beebe in his book on "The Bird." He tells us that even "The horn of a rhinoceros is only a solid mass of agglutinated hairs, while as the antithesis to this may be mentioned all down and feathers, from the hummingbird's fluff to the conda's pinion."

A close inspection of a newly hatched bird shows that the body is covered with microscopical tufts of down. These, however, are soon pushed away by the true plumage. The early stages in the growth of a feather suggest little camel's-hair brushes set in a quill. The feather unfolds as if it were pushed out of the quill or sheath, but in some feathers the unfolding seems to take place next to the bird's body, while the tips remain in the sheath as the development gradually proceeds.

## Sumatra's Giant Arum

DID you ever see a gigantic arum plant? It grows in the East Indies, so the chances are you haven't. But a perfect life-sized model of one may be found in an English garden.

A picture of it is shown herewith, and beside it stands the modeler. His name is H. E. H. Smedley, and he lives near the town of Brighton, England.

One may get a good idea of the size of the huge plant from this picture. Mr. Smedley is not a small man, yet the plant towers more than twice as high as its maker. In fact, it is of gigantic size, the stamen extending about fifteen feet up in the air.

He couldn't grow this gigantic plant in his garden, so he modeled one himself

The strange leaves have many large perforations in them. The plant belongs to the *Araceae* family and has many near relatives scattered over the earth, notably in the regions bordering the Mediterranean. Great Britain has some diminutive members of the family, the best known being the wake-robin, from the root of which is obtained arrowroot.

Mr. Smedley has devoted his life to modeling strange plants, but this is the first one he has built out of doors. In consequence he had to procure special weather-proof materials with which to make it. He then painted it in varying shades of purple and green to correspond with its natural coloring.

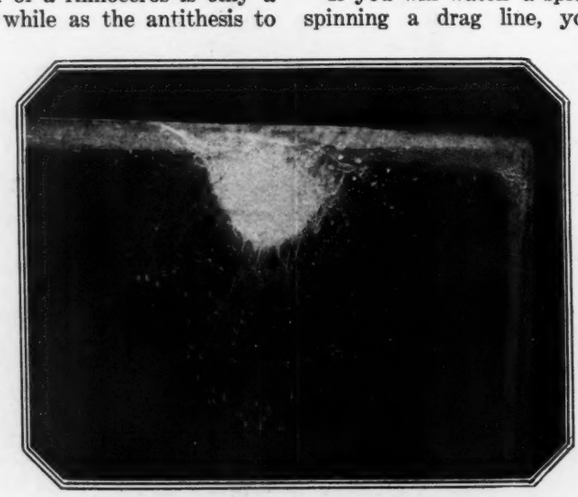
## How the Spider Attaches Her Web to Glass

WHEN a spider moves from place to place to spin her web, she runs a drag line to mark the course. This is composed, not of a multiplicity of tiny threads from the spinnerets, but of a comparatively small number, perhaps only two.

If you will watch a spider running along an object and spinning a drag line, you will notice that at frequent intervals she fastens the line. Merely to make the end of the drag line adhere would not enable it to exercise its full strength: it is fastened by an attachment disk. This may easily be observed by enclosing a living spider in a bottle, when she will fasten the drag line to glass.

The attachment disks may be examined with the help of a lens. Even under a pocket lens, the disk is seen to be composed of a large number of fine threads.

The accompanying illustration was made from a large number of these attachments on the inside of the glass door of a bookcase.



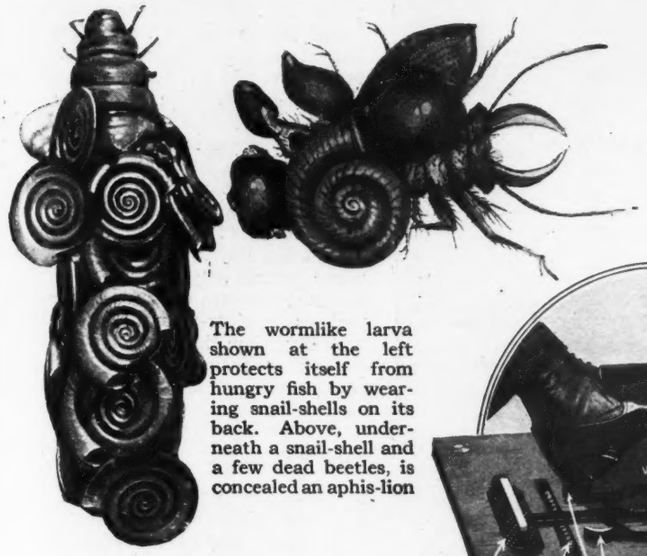
The end of each drag line is fastened by an attachment disk, easily seen on glass, as here

# Snail-Shells Fool the Fish

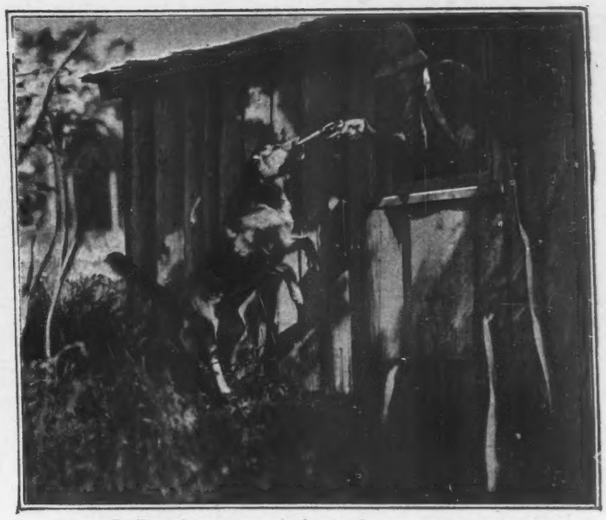
SUPPOSE you were a soft, wormlike larva at the bottom of a stream, and a school of hungry fish swimming by spotted you. You'd give up without a struggle, wouldn't you? Generations and generations of larvae have gone through this harrowing experience, but a few wise ones have managed to escape. How? By ingeniously disguising themselves.

Take, for example, the larvae of the caddis-fly. Their favorite trick is to deck themselves out in the shells of small snails, though they sometimes resort to leaves, stones, and sand. These various substances are held together by means of silk spun by the larvae. One snail-covered larva is pictured here—three times its natural size. It is a most unappetizing sight, and you can easily imagine yourself, as a fish, turning it down.

Aphis-lions, when young and comparatively helpless, camouflage themselves just as larvae do. They likewise carry around on their backs snail-shells, and also bits of beetles.



The wormlike larva shown at the left protects itself from hungry fish by wearing snail-shells on its back. Above, underneath a snail-shell and a few dead beetles, is concealed an aphis-lion



Police dogs are taught to leap at a gun at the very moment when it is being fired

# Police Dogs Under Gunfire

THEY are sending dogs to college now and graduating them with a purchase price of $1,000 and more on their heads. They are trained from puppyhood up to rescue drowning persons, and to track down criminals and meet attack from an armed thug who may carry a knife, revolver, club, or other weapon. When they have finished their training course they go to metropolitan police forces.

Ordinary dogs do not take kindly to gunfire, but the German shepherd dog will not only advance in the face of pistol fire, but will attack the hand holding the weapon. Before he reaches this stage, however, he must have guns fired near him until he no longer fears them. So well trained are the dogs that at the first flash of a weapon they will leap at the hand holding it.

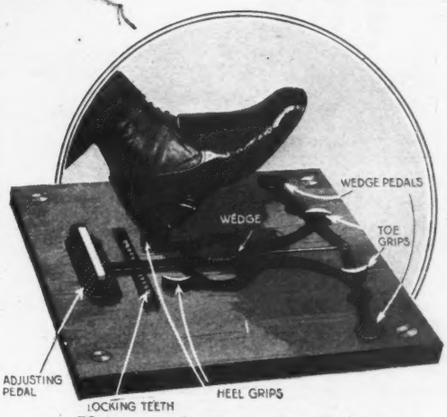
There are two police-dog colleges in operation. One is at Scranton, Pa., and the other at West Hempstead, Long Island.

# Let Your Feet Remove Each Other's Rubbers

CAN you balance yourself on one foot while the other one paws the ground? If so, you can use this new rubber-remover. It is mounted on a wooden base. Two clamps like those on an ice-skate grip the rubber. The clamps are operated by a pedal and a lever worked by your idle foot. The lever is for tightening the clamps. It has two arms and is located at the toe of the device. You push the lever inward and a wedge to which it is attached is pulled upward. This forces the arms that hold the clamps to come together. The clamps grip tight. That is why it is necessary for you to know how to paw.

Next you remove your foot from the rubber, and a spring will adjust the clamps to their original position. At the rear of the device is the pedal that—when moved back and forward—will increase and decrease the distance between the clamps to suit any sized foot.

You can readily appreciate that it requires skilful foot movement for anyone to attempt to use this rubber-remover.




If you don't like to handle dirty rubbers, try this new foot-operated rubber-remover, worked by levers

Father goes into action just abaft the electric light plug with the assistance of this new spanking-machine

# Exit the Slipper

"I'LL see you in the woodshed after tea." Thus spake the fathers of yesterday; and when the time came there was a brief application of switch or slipper. Now all is changed, or about to be, since the recent Electrical Show at Madison Square Garden in New York city. The modern formula of punishment will run something like this: "I'll see you at the electric light plug"; and there will follow the "plugging in" of the spanker.

Later, when the small boy investigates this new enemy of his tribe, as of course he will, he will find a small motor, which drives a connecting rod about four inches long, terminating in an "applicator" about the size of the average parental palm.

Father will have to get some more modern phrase than the ancient "This hurts me more than it does you"—unless there should be a short circuit.

## The Squasher—Otherwise the Wasp-Gun

CLAP! You've squashed another mosquito. Ah, but your hands are smeared with his blood. Would it not be considerably neater to use the wasp-gun shown above? Though it specializes on wasps, it will kill any other insect with equal vim.

It is called a gun, but the trigger is the only thing it has in common with an ordinary gun. When you pull the trigger, the jaws at the end of the gun snap shut and squash any insects that happen to be standing on either jaw at the time. Your job is to lure the insects to the trap.

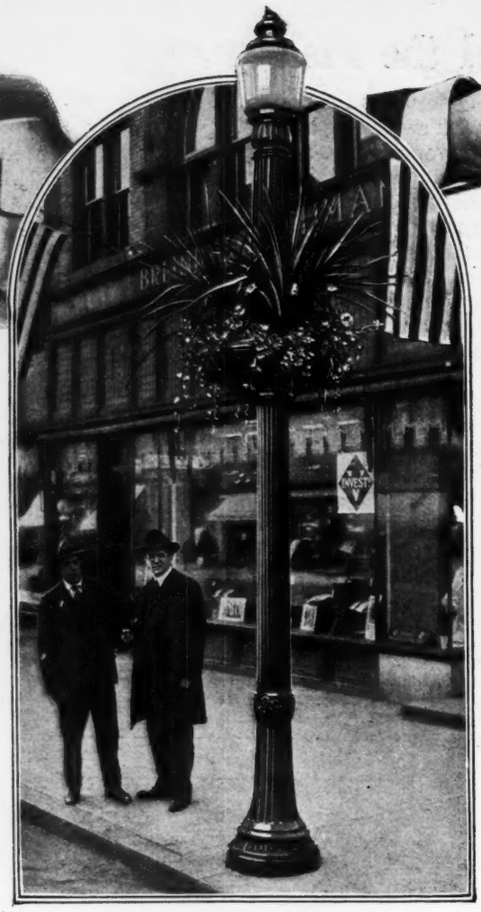
Here is a suggestion. If your quarry is a mosquito put the end of one finger in the trap; in time the mosquito will land on it. You withdraw your finger with such great speed that the mosquito will be left behind; if at the same time you pull the trigger your victim will be squashed.

The gun should be cleaned at regular intervals, lest it become clogged.

## Flowers for a Fighting Aviator

LOS ANGELES is the capital of the kingdom of flowers as well as of movie queens. Any public event there is the excuse for floral decoration, artful and artistic. So it followed, naturally, that when Captain Eddie Rickenbacker, first ace of our fighting airmen in France, came that way, the biggest bouquet yet was handed to him—and he'd been on the receiving end of the bouquet game ever since he got home from the war.

This time he found himself all but smothered in a flower-bedecked automobile tricked out to resemble an airplane, and in this state he rode through the streets of the welcoming city.



## Flowering Lamp-Posts

TURNING the street lamp-posts into things of beauty is the object of the authorities of Allentown, Pa.

In that city every lamp-post wears a hanging-garden effect from spring until late autumn. The flowers and decorative leaf-bearing plants are planted in urn-shaped globes which encircle the lamp-posts some distance below the light.

The city fathers who thought of and adopted the flowering lamp-post idea made a thorough job of beautifying the town by removing all of the overhead telephone and telegraph wires—at least, in the principal streets.

But Allentown can boast of use as well as beauty. It is the county seat of a farming section which ranks as one of the leading potato producers of the country.

## Exit Corkscrew, Enter Cigar-Cutter

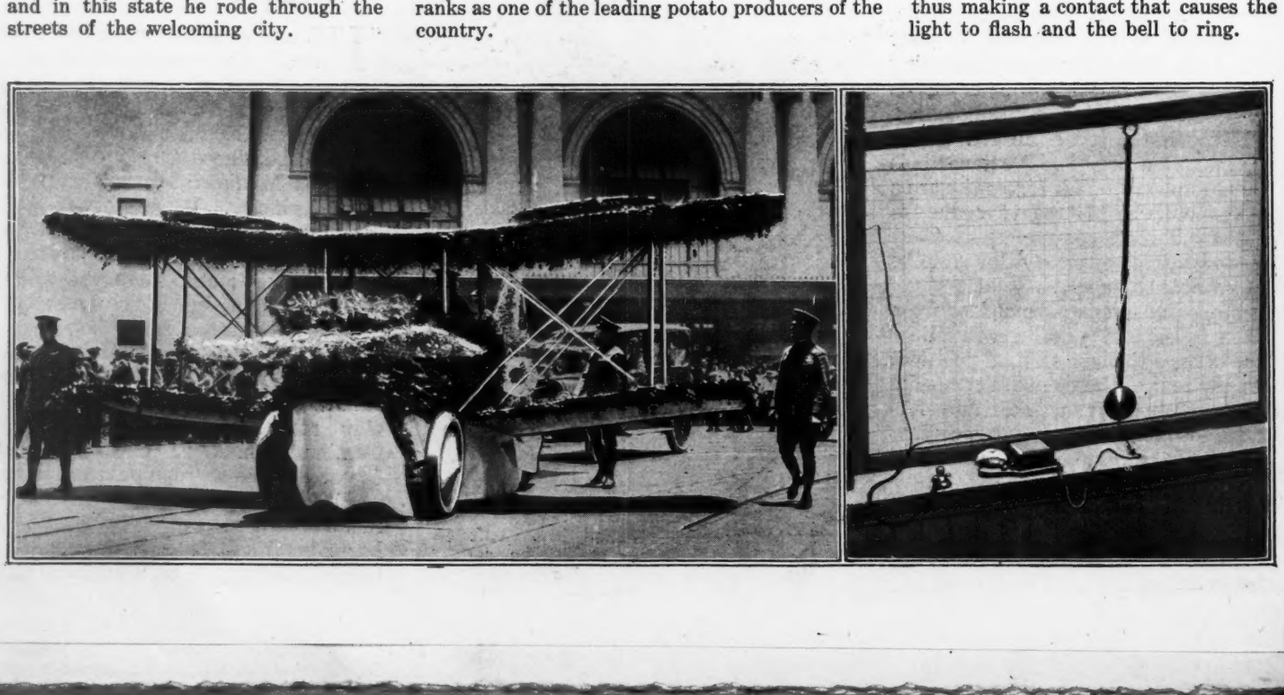
ONCE upon a time a pocket-knife with a corkscrew attached was looked upon with favor; but what's the use of a corkscrew now? Probably corkscrew knives will be a drug on the market even in the ketchup and horse-radish belt. But smoking is still numbered among the permitted delights, and so, as the corkscrew steps down and out of the knife-handle, in comes the cigar-cutter. With the device shown in the accompanying photograph only a slight enlargement of one end of the knife-handle is necessary in order to accommodate a cutter that will snip off the end of a cigar with all the neatness and despatch of the shop cutters.

In these days, when, as some one wrote recently, "you can now buy an excellent five-cent cigar for a quarter," perhaps a cigar-cutter is a greater necessity than in the care-free old days when many of us said: "Bite off the end; let the butt ravel as it may."

## The Birth of a Second

EACH new second is heralded by a flash of light and the ring of a bell in the factory of an electrical firm in Providence—not to remind the workers that the dire day of doom approaches, but to help them in their work.

Often men must count seconds accurately for certain operations while they watch their work closely. This concentrating on two things at one time is very difficult. It is simplified by the new second-announcer shown below. As the pendulum of the clock swings to the right it touches a wire, thus making a contact that causes the light to flash and the bell to ring.



## Blend Your Smoke in Twin Cigarettes

ONE of the twins was born in Virginia and the other in Turkey. What's that? We are talking about the twin cigarettes in the picture below.

Many smokers like a cigarette in which Virginian and Turkish tobacco are blended, but they are seldom satisfied with the quantity of each used. So one wise tobacconist devised the twin cigarette, one of which is made of Turkish tobacco and the other of Virginia tobacco. Thus the smoker can draw on both at the same time and concentrate his effort on one, blending to suit himself.

## The Reason She's Light-Footed

AN up-to-date jewelry thief does her shoplifting with her feet—not by brazenly kicking over a tray of jewels, but gently pushing the jewel she wants from the counter and then stepping on it with her heel. A layer of soft leather is tacked to her heel and the jewel sinks into it. Off she goes, and later in the privacy of her home (do thieves have homes?) she digs out her prize.

Below you see a jewelry thief's shoe, stocking, petticoat, and prize ring. Judging from the quality of her clothes, she must do a thriving business.

## But Will They Wash?

THE intrepid photographer who brought in this picture informs us that the woman in the studio hosiery department is a Berlin girl who has "decided to adopt the fad of New York and London and have her stockings painted on."

We shall have to take his word for it; if this "fad" has made headway in New York we have overlooked it. We fear, however, that the colors may not be fast, and so we cannot recommend the method to those seeking for a way to reduce the high cost of stockings.

## A Capitalist Plays Santa Claus

MERRY Christmas! Judging from their happy smiles, it certainly is a merry one for the children in the picture below. Each child is laden with a box of animal crackers, a large red apple, and a Christmas stocking full of good things. Behind the children there are hundreds of similar stockings stacked up against the wall to be given to hundreds of other children.

Who is playing Santa Claus? The firm for which the fathers of these children work. In order to have enough to go round, thirteen thousand stockings had to be bought and filled; twenty-six barrels of apples and twelve thousand packages of animal crackers were also bought. Each stocking was filled with candy, toys, and nuts.

Twenty years ago there were hundreds of American children whom Santa Claus passed by. But today there are so many organizations playing Santa Claus that almost every child is sure of a merry Christmas, and it isn't very difficult to realize how much it means to them.

## He's Seven Feet Six

"YOU'RE too tall," said the doctor, when Mr. R. E. Madson tried to enlist in the Marines. Harsh words, but true; Mr. Madson measures seven feet six inches with his shoes off. What chance could he stand of dodging bullets, shrapnel bits, and other things that fly around above battlefields?

He comes from a ranch in Ranger, Texas, and he carries his cow-boy clothes very well, as you will see in the picture here. It was in this get-up that he appeared in Washington to watch the Marines parade. Even though he couldn't join them, he was at least able to see them parade, since he towered over the heads of the crowd.

Had Mr. Madson been a German trying to enlist in the former German army he would have been promptly accepted; for the German Emperors always surrounded themselves with a guard of the tallest men they could find. Frederick the Great started the habit, and all his successors kept it up. Tall men are out of business now.

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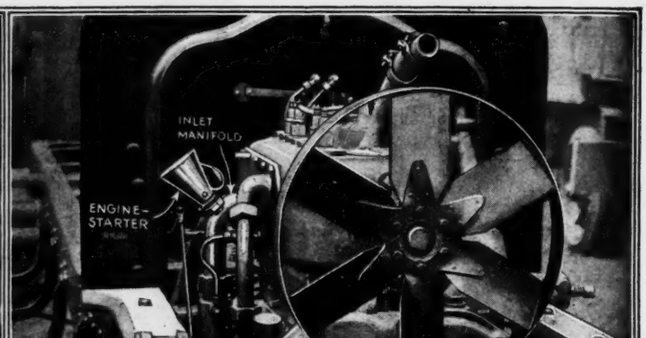
This machine overcomes the two difficulties of eliminating spongy spots and thinner treads at certain points

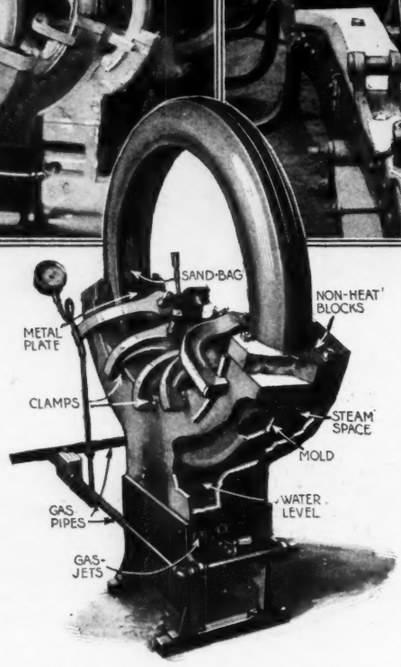



A device that will start a gasoline engine even in zero weather: it is the clever invention of an Englishman

## A New Way to Retread Automobile Tires

ASIDE from embodying non-heat-conducting blocks, a new retreading machine consists of a hollow segmental mold with a space for water below and a gas-burner for heating the water and steam-curing the retread rubber, which is first of all built up on the tire itself. After this is done, a sand-bag is placed inside the tire and the latter placed in the mold. A heavy steel band is then placed upon the sand-bag and the pressure clamps applied. The gas-burner being lighted, the tire is kept in the mold until that segment is cured.

Three sizes of molds may be used in the base of this machine. The apparatus may also be furnished without burners, to be connected with the garage steam plant line.



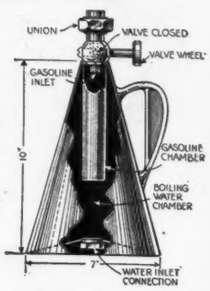

Here is the complete tire-retreading machine fitted with the gas-burning apparatus and clamps

## You Can Make an Engine-Starter Like This

ENGLAND'S winter climate makes it especially hard to start big truck engines, so it fell to the lot of an Englishman to invent a simple cold-weather engine starter.

It consists of a conical bottle from the apex of which is sweated a cylindrical tin chamber that extends half way down to the bottom of the can. This is filled with gasoline through a small plug very near the top, while the space that surrounds it is filled, just before the engine is started, with boiling water. This heats the gasoline and causes it to leave the top of the chamber through a special stop-cock in a fine spray which is fed into the intake manifold of the engine.

After the truck engine has been started the valve is closed and the device removed, to be used again next morning.



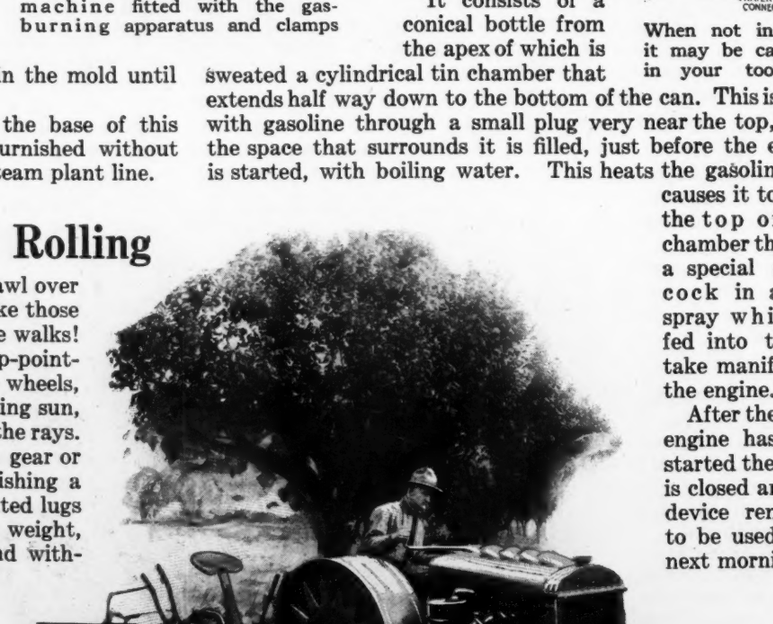

When not in use it may be carried in your tool-box

## It Walks Instead of Rolling

MOST farm tractors roll on wheels or crawl over the ground on track-laying units like those on the war tanks. The tractor shown here walks!

This is made possible by providing sharp-pointed lugs on the bearing surfaces of the rear wheels, so that the wheel looks something like a rising sun, with the pointed lugs corresponding to the rays. The pointed lugs act on the ground as a gear or cog, and sink down to solid ground, furnishing a positive traction in every soil. These pointed lugs give a positive traction without surplus weight, without loss of power through slippage, and without packing the soil.

The complete tractor weighs less than three horses and does the work of eight. It has a short turning radius, made possible by the use of a separate clutch for each rear driving wheel, with no differential. The apparatus is adaptable to a great variety of work, but is uniquely suited to cultivating orchards where it walks in and out among the low-hanging trees without difficulty because a part of the rear wheels is always below the surface of the ground.



It might be said that this tractor walks instead of rolls over the ground: it is admirably suited for orchard cultivation

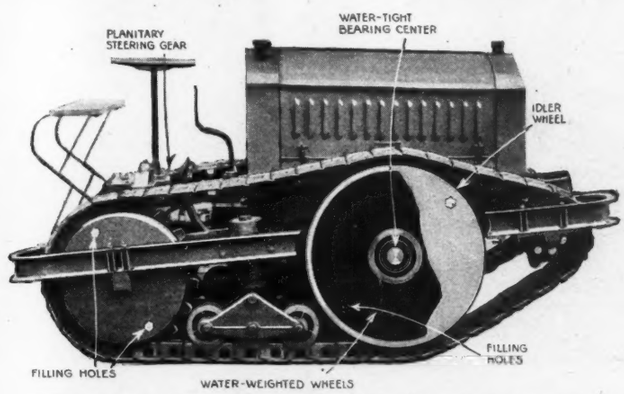
# Water Wheels on a Farm Tractor

ONE of the newest forms of farm tractors of the creeper or track-laying type has water wheels. Of course, the wheels are not made of water, nor does the machine run on water. The expression simply means that the two main idler wheels and the two driving wheels over which the creeper treads operate may be filled with water to within two inches of the top.

The purpose of filling the wheels with water is to enable the operator to change the weight of the machine to suit soil conditions. Approximately one thousand pounds of water may be carried in the four wheels, so that the total weight of the tractor may be varied from four to five thousand pounds, according to whether the soil is relatively hard and dry or soft and sticky.

The tractor is made in Ohio, and its manufacturer says the water-carrying feature is an economy not enjoyed by any other machine; water is cheaper than sand for ballast and may be more readily obtained.

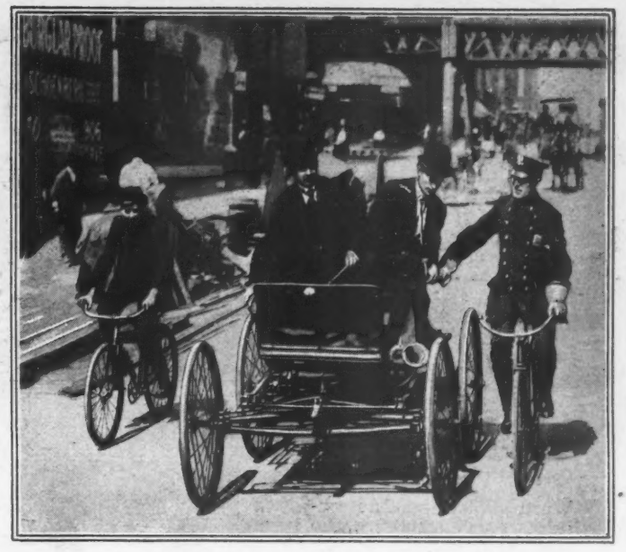
The water is carried without damaging any other parts of the machine by making the hubs a separate part of the




The wheels on this tractor may be filled with water to increase its weight. A special arrangement permits it to slip one track and deliver all the power to the other when necessary

wheel. The drums are welded to the hubs and to the sprocket teeth, so that the wheel drum is water-tight. The bearings are enclosed in the hubs, so that the water cannot get to them.

The volume of water to be put in each wheel depends upon the amount of traction required; but each can be filled to within two inches of the top, since the plug is about one inch in diameter and is one inch from the rim.



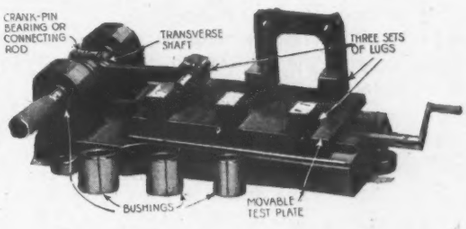
Not speeding, but blocking traffic with his new-fangled contraption; it was in the year 1895

# He Impeded the Traffic

IT is difficult for us to believe that a quarter of a century ago an automobile was a curiosity. Elwood Haynes, of Kokomo, Ind., produced what is said to be America's first successful automobile. In 1895 Mr. Haynes took his creation to Chicago, and was driving the "horseless carriage" down Michigan avenue when he was stopped by a policeman on a bicycle.

What a transformation two decades have worked! The sight of a horse and buggy on Michigan avenue today would attract attention. Little did that bicycle "cop" (one of whose duties undoubtedly was to see that you did not cross a bridge "faster than a walk") realize that in a few years six million motor-cars would be in operation.

A mechanical detective that discovers misalinement in connecting rods, thus avoiding costly repairs



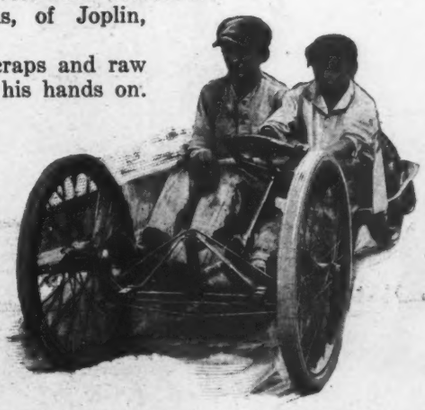

# A Juvenile Bikemobile

THE bikemobile herewith is capable of a speed of twenty-five miles an hour with the motor wheel attached. Fred Harley, a fifteen-year-old genius, of Joplin, Mo., is responsible for its creation.

Harley constructed his tri-car from scraps and raw ends of nearly everything he could lay his hands on. Its frame is that of an old worn-out bicycle. The front was straightened out and attached to the axle of a mail-carrier's bicycle. To this he attached an old automobile steering wheel.

The twin seats straddle the bicycle frame connecting the rear wheel to the front axle. A hand-brake is accessible to both passengers, and the steering wheel can be operated from either side of the vehicle.

It lacks a self-starter and must be pushed until the motor wheel's engine begins to fire. Then the rider jumps on the side seat and away he goes.



Not satisfied with owning a motor-wheel, this young man decided to make himself a regular automobile

# It Explains the Knocks

MISALINEMENT of connecting rods is generally due to heat warping the metal of the rod and twisting one end of it, so that the crank-pin and wrist-pin bearings are out of line.

The apparatus of the alining-machine shown above consists of a flat bed-plate on which is set a test-plate carrying three sets of lugs. This test-plate may be moved longitudinally off the bed-plate by means of a hand-screw. At the other end of the bed-plate is set up a transverse shaft or pin exactly parallel with the transverse surfaces of the lugs on the movable test-plate.

If the bar through the wrist-pin bearing does not contact exactly evenly with the surface of the lug, it indicates that the connecting rod is bent and the crank-pin and wrist-pin bearings are out of line.

# Are You Going to Fly?

## Up-to-date passenger-carrying a Pullman car, speed through the

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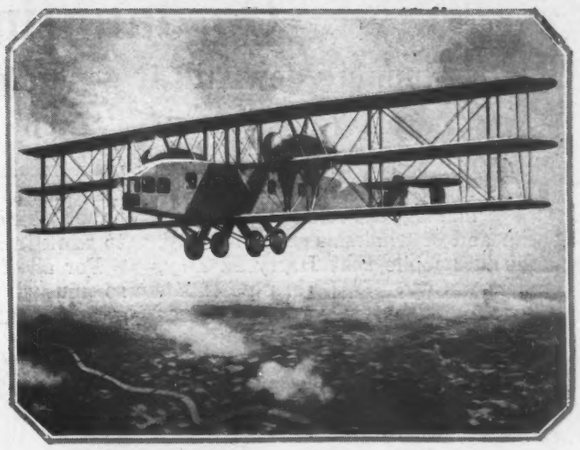
When airplane-builders consider even luxuries, who shall say that the day of commercial flying is yet to dawn? Look at these neat little curtains on the windows of the Handley-Page aero-bus, which regularly cleaves the air between Paris and London; then look a little harder and see the comfortable wicker chairs inside

American ideas of comfort in the air are shown in this *Eagle* airplane, with its upholstered wicker chairs for seven passengers, whipcord lining dome, and windows of non-breakable glass. It is the first three-motored machine to be produced in this country. Its 450 horsepower drive it at one hundred and seven miles an hour. If used for freight it can carry more than a ton of useful load

A veritable giant of the air is the *Braemar*, of England. Her span of wing is 81 feet and 8 inches. Her four Liberty engines of 410 horsepower each drive her through the air at a speed of one hundred and twenty-five miles an hour. Besides pilots and engineer, the *Braemar* carries some fourteen passengers. Add to this 450 gallons of fuel and 40 gallons of oil for a 500-mile flight and 280 pounds of mail (about 3,000 letters) and you wonder when you will be buying your ticket for a flight to Chicago or New York. In this picture the *Braemar* is shown with her war fuselage

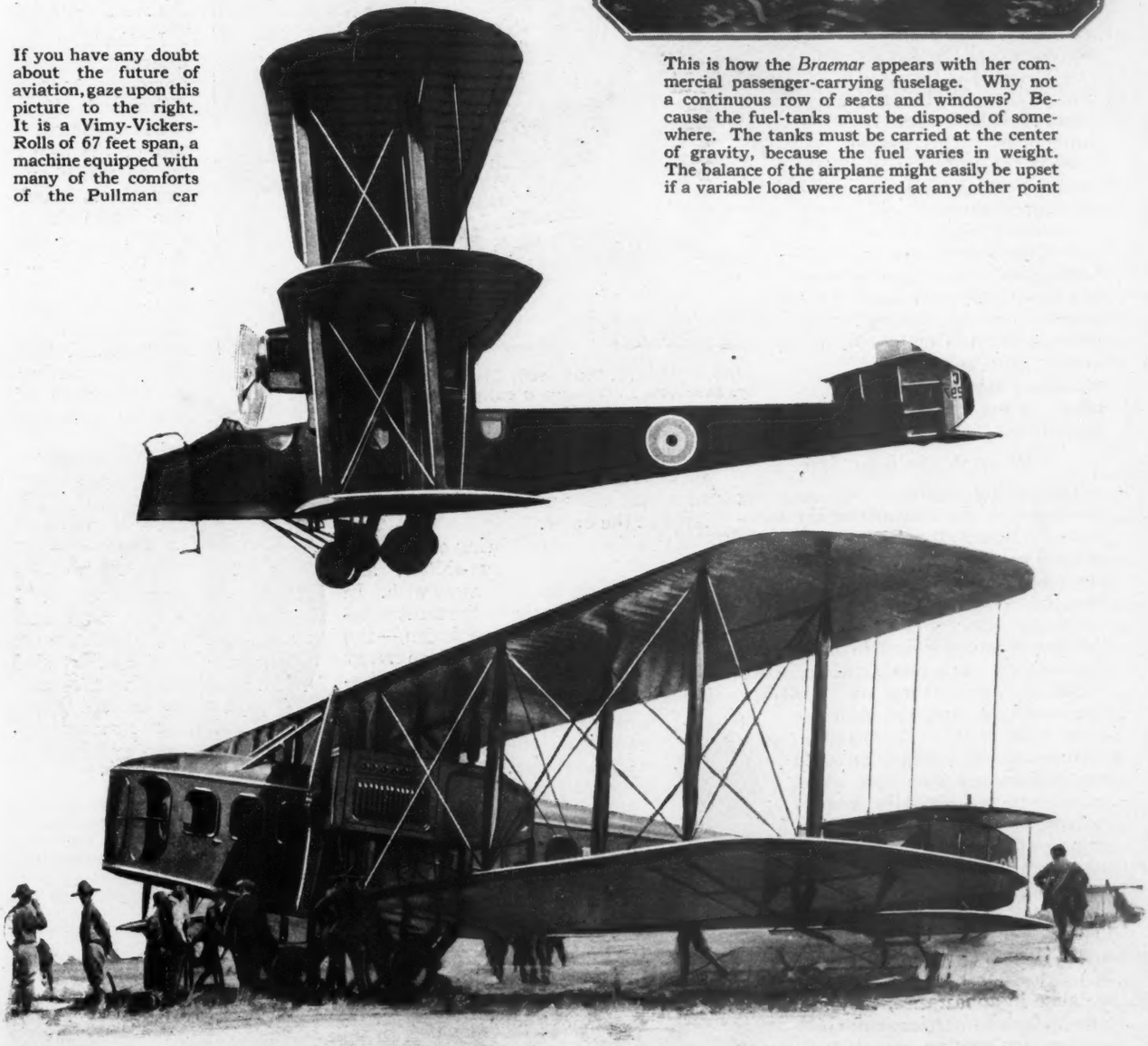
# The Air Giants Are Ready

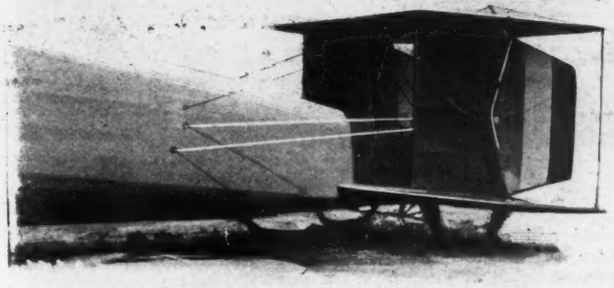
## airplanes, with all the comforts of air at the rate of 125 miles an hour



This is how the *Braemar* appears with her commercial passenger-carrying fuselage. Why not a continuous row of seats and windows? Because the fuel-tanks must be disposed of somewhere. The tanks must be carried at the center of gravity, because the fuel varies in weight. The balance of the airplane might easily be upset if a variable load were carried at any other point

If you have any doubt about the future of aviation, gaze upon this picture to the right. It is a Vimy-Vickers-Rolls of 67 feet span, a machine equipped with many of the comforts of the Pullman car





The Lawson *Air-Liner* has been living up to its name by flying across country from Milwaukee to Chicago, Cleveland, Toledo, Buffalo, Syracuse, and New York, carrying nine passengers. The machine has a wing span of 95 feet. It covered the distance from Syracuse to New York (313 miles) in 2 hours and 47 minutes, while some of the passengers were playing bridge in the enclosed cabin. Lawson claims that his machine can carry twenty-six passengers sitting down, and sixty strap-hangers

# Go Jaunting in an Electric

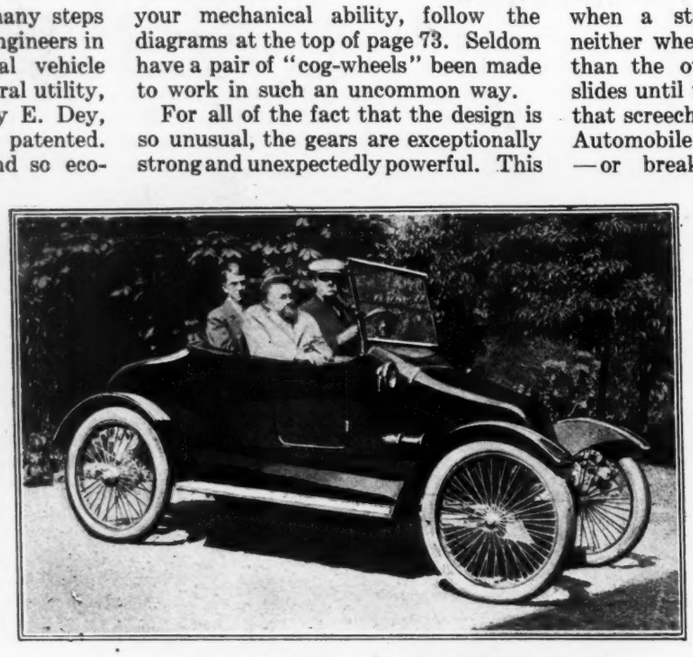
## Running downhill it generates power to help you up the next grade

**By Lloyd E. Darling**

MOST recent of the many steps taken by electrical engineers in making the electrical vehicle cheap and of wholesale general utility, is the automobile that Harry E. Dey, of Jersey City, N. J., has patented.

So simple, so efficient, and so economical is this machine that Dr. Charles P. Steinmetz, of Schenectady, N. Y., one of the country's leading electrical engineers, said some time ago that Mr. Dey has apparently solved the problem of the five-hundred-dollar electric automobile. This means much to the general public. Consider the following uncommon points.

The most important feature of the design hinges on making an electric motor run the wheels of an automobile directly—that is, without the use of intervening shift gears, differentials, or any other of the usual power-transmitting appliances.



Harry E. Dey (at the wheel), Charles P. Steinmetz, and Dr. Steinmetz's adopted son enjoy a ride in the electric

### *Motor on the Rear Axle*

This is accomplished by mounting the motor on the rear axle of the automobile. In fact, it is a part of the rear axle. The armature of the motor drives one wheel; the field, the other. Armature and field naturally turn in opposite directions, since only in this way can they both revolve at once in one and the same motor. As a result, the armature would ordinarily turn one wheel in one direction, and the field the other wheel in the other direction.

Obviously, an automobile could not get anywhere if one rear wheel traveled in one direction and its mate in the opposite way. To get around this objection, Mr. Dey interposes a set of internal gears, one on each side of the motor, as shown in the drawings at right. (The working of these gears is shown in detail at the top of page 73.) Although both sets of gears are alike in appearance, they are quite different in action, since one reverses the motion transmitted to it, while the other does not.

Thus, although field and armature move in opposite directions, both rear wheels go forward—which is the end desired.

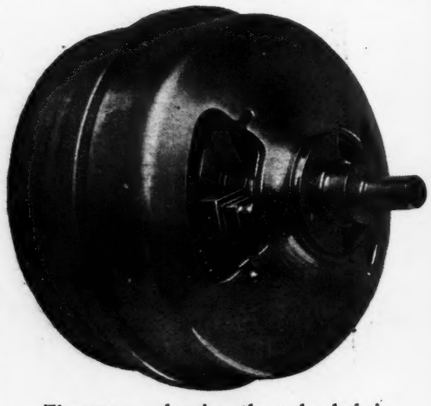
These gears are among the most compact and ingenious man ever devised. If you pride yourself on your mechanical ability, follow the diagrams at the top of page 73. Seldom have a pair of "cog-wheels" been made to work in such an uncommon way.

For all of the fact that the design is so unusual, the gears are exceptionally strong and unexpectedly powerful. This is because the teeth have such broad bases, and so many of them are in contact at all times—this as a result of the fact that the inner gear is nearly as large as the outer.

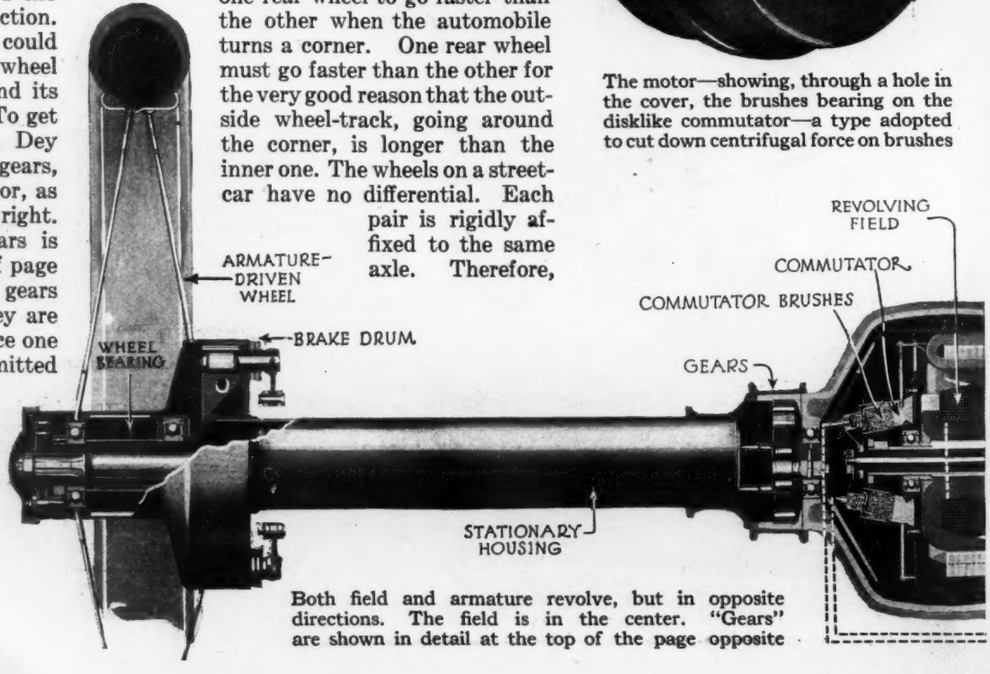
As to the motor, it being on the rear axle, all clutches, gear-shifter, and power-shaftings are done away with. In fact,—and this is one of the most noteworthy features about the design,—the customary differential is done away with also. A differential is that contrivance on an automobile which permits one rear wheel to go faster than the other when the automobile turns a corner. One rear wheel must go faster than the other for the very good reason that the outside wheel-track, going around the corner, is longer than the inner one. The wheels on a street-car have no differential. Each pair is rigidly affixed to the same axle. Therefore, when a street-car turns a corner, neither wheel of a pair can go faster than the other, and so one of them slides until the corner is passed, causing that screeching noise you have noticed. Automobile wheels would screech also—or break—if there were no differential to come into action at corners.

### *No Need for Differential*

In the Dey automobile, designed as it is, there is obviously no need for a differential. If a corner is to be negotiated, the armature or the field (depending on which one of the rear wheels is on the outside track) simply moves a little faster than usual, and the corner is rounded easily and noiselessly. Since there is no mechanical connection between the armature and the field, it is obvious that either of them can accomplish this faster rotating independently of



The motor—showing, through a hole in the cover, the brushes bearing on the disklike commutator—a type adopted to cut down centrifugal force on brushes

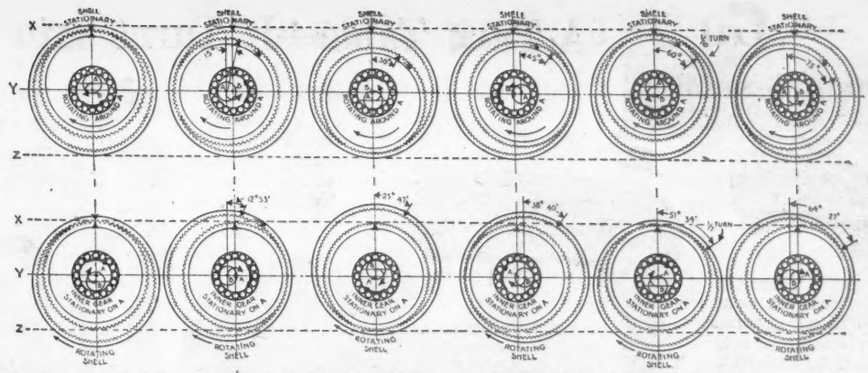



Both field and armature revolve, but in opposite directions. The field is in the center. "Gears" are shown in detail at the top of the page opposite

### Armature Gearing

At the right (top row) are shown successive positions of the gears that appear in edgewise view to left of the motor shown at the bottom of page 72. The object of these gears is to reverse motion from the armature, so that the left rear wheel will move in a forward direction.

As the armature shaft (whose center is B) revolves crank-pin A to the left, the inner gear, mounted on crank-pin A, must turn to the right, because the teeth on its edge are in contact with those on the "stationary shell," or outer gear—as a result of the $\frac{1}{32}$-inch throw of crank-pin A.




### Field Gearing

The lower row at the left gives successive positions of the same gears that are shown in edgewise view at the right of the motor in the drawing at the bottom of this page. The object is to effect a reduction in the gearing corresponding to that secured with the armature gearing (7 : 1 results in this case; 6 : 1 in that of the armature), though it is not in this case desired to reverse the motion, since the field is already moving in a forward direction.

The inner gear is held in a fixed position by the axle housing, instead of the outer gear, as was the case with the armature. The outer gear ("rotating shell") is thrown around in a circle of $\frac{1}{32}$-inch radius by a crank-pin affixed to the field's shaft. It revolves in the same direction as does the crank-pin, owing to the ingenious peculiarity of this kind of gearing.

A pronged driving shaft is affixed to the outer gear, conveying its motion to the right rear wheel.

Notice that in the upper row of drawings B, the center of the outer gear, is fixed, while A, the center of the inner gear, revolves around it. In the bottom row this is reversed.

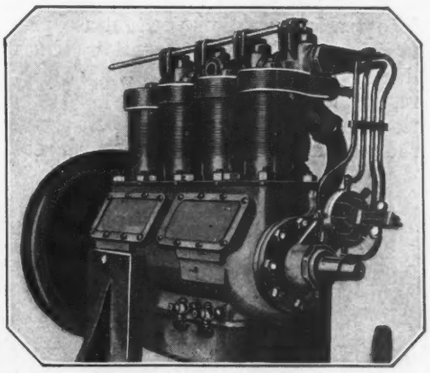
X, Y, and Z in both sets of drawings are merely reference lines, demonstrating, in the upper row, that the outer gear stays in the same position throughout; while in the lower the inner gear holds the fixed position. Follow through the changes

The net result is that, though the armature shaft moves to the left, the inner gear moves to the right. It remains only to couple on to the inner gear in some way in order to transfer its motion to the automobile's rear wheel.

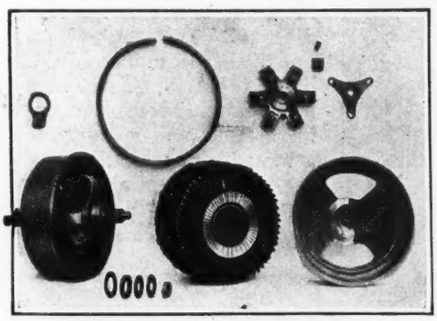
This is done by a driving shaft, the pronged right-hand end of which fits into the webbing of the inner gear. Its other end is affixed to the outer end of the wheel-hub through the medium of a flexible joint. The driving shaft always describes a cone in its revolving, for the gear to which its right-hand end is affixed always revolves in a circle of $\frac{1}{32}$-inch throw, as described. The shaft is free to describe this cone because of the generous diameter of the housing. Note that the driving shaft bears no weight. The housing does that, ball bearings intervening. Though unusual, the power system works uncommonly well throughout the other. Thus is one of the most expensive parts of an automobile's transmission—the differential—done away with.

### *Both Armature and Field Revolve*

The fact that in the Dey motor both armature and field revolve brings another advantage; with both of them revolving at a given speed, they give twice the power that one of them revolving alone would give. Thus the motor is twice as powerful as any other of its size. This is a material factor in cutting down the size of the bulge in the rear axle necessary to accommodate the motor, resulting in a saving in weight and cost. It is all legitimate gain also, and not at the expense of hill-climbing power, battery strength, or other factors.



Light engine under hood may charge batteries both when car is in motion and when it is not. Going uphill, it assists batteries



At the left is shown the motor field, outer case; in the center is the armature; at the right, the cover. Notice that the field is but one coil: the core ends bent around form six poles

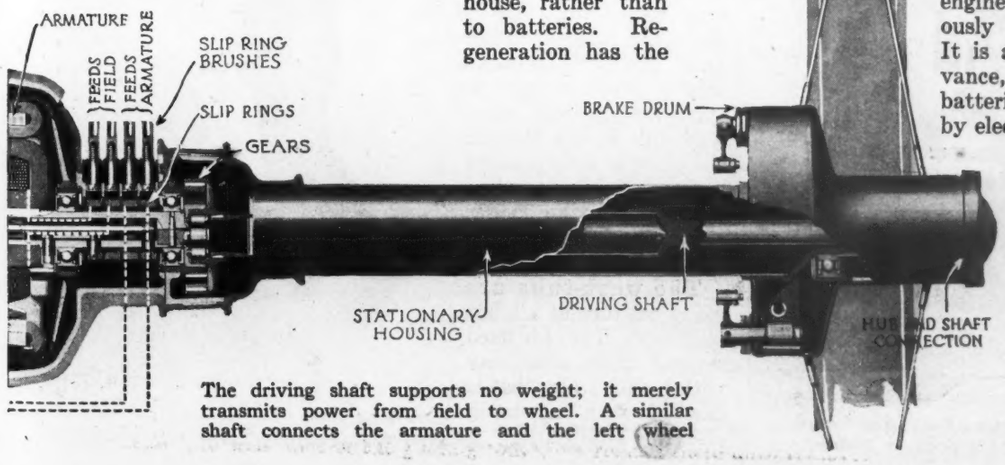
The car is run by storage batteries. The control is such that when going downhill the motor acts as a generator and returns power to the batteries. This "regenerative" feature is now widely practised on electrified steam railroads — in this case, however, returning power to the powerhouse, rather than to batteries. Regeneration has the advantage that brakes are almost unnecessary. The motor, when acting as a generator, takes up so much power that it holds back the car automatically. Naturally, the batteries do not have to be charged so often. Of course, the power coming from down grades can never quite equal that paid out on up grades because of mechanical and electrical losses in the machine. But an appreciable saving results.

### *Portable Charging Station*

Under the hood the machine may carry a light four-cylinder gasoline engine and generator to act as a portable charging station. Charging may be done even while the automobile is running. In fact, a move of the control lever puts both engine set and the batteries in various series and parallel combinations, in order to furnish the motor with extra power for emergencies. Mr. Dey has designed such a charging set.

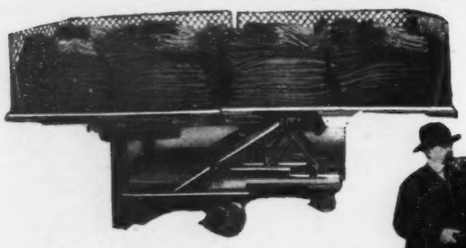
The new automobile is not as yet being manufactured commercially, only experimental cars so far having been built. But these hold out much promise. In the opinion of experts, the machine easily qualifies as a regular and consistent competitor of the low-priced, well made gasoline car.

Eight or ten years ago electrical engineers first began to talk seriously of the low-priced electric. It is an especially desirable advance, for the reason that the batteries may be charged cheaply by electric light plants after midnight and in the early morning hours, when there isn't much other load on the generators. Thus both the stations and the automobile user profit. Some day charging stations will probably supplant the gasoline service stations now so common all over the country.




The driving shaft supports no weight; it merely transmits power from field to wheel. A similar shaft connects the armature and the left wheel

# A Turn Table—It Turns into a Truck



To turn this table into a truck, release the lever running diagonally from the right section of the table-top to the ground. Now raise the left section (second picture) until it tops the right section, and slide the sections toward each other until the upper one is directly above the lower one

The result is a truck that fits easily on the elevators in shifting goods

A TABLE that will conveniently turn into a truck is shown herewith as a table, as a truck, and on its way from one to the other. It is piled high with coats and vests, for it is used in a large clothing manufacturing plant. Thus the necessity of transferring merchandise from tables to trucks is entirely obviated.

Take, first, the device when used as a table. You will notice that the two sections are held together in the same plane by a long lever attached to the right section and extending on to the ground.

When you wish to move the sections into truck formation you release this lever and the right section slides down to the base of the device, resting there on rollers. The left section is then raised so that it just clears the top of the right section. Both sections are then moved toward each other until the upper one is directly above the lower one.

It is now a truck. You will notice on the truck a lever running diagonally across from one section to the other. If you will look back at the first picture of the device—as a table—you will notice that same lever. It keeps the two sections linked together throughout their varied maneuvers.

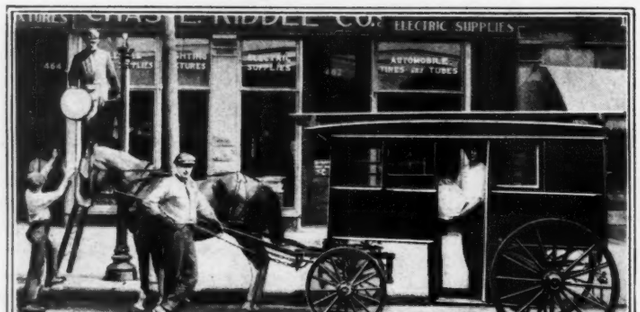
## Scraping Old Bricks for Future Use

"BEGOB, your fortune is made!" So said Jack Downey, a boss mason, to Mr. N. T. Fuller, of New Bedford, Mass., when he tried out his brick-cleaning machine.

In the picture below Mr. Fuller himself is shown holding the brick in place while a saw-toothed blade comes down and scrapes off the mortar; the blade continues to rise and fall until the brick is scraped clean.

The blade is bolted to an arm, which is bolted to a wheel. On the axle of the wheel is a gear that meshes with a small gear which is attached to an electric motor.

Mr. Fuller's machine scrapes the mortar from used bricks; it cleans nine bricks a minute




The globes are washed once a week, once in two weeks, or once in three weeks, according to the dirt of the different districts in which they are located

## Cleaning Up the Bright Lights of the Great White Way

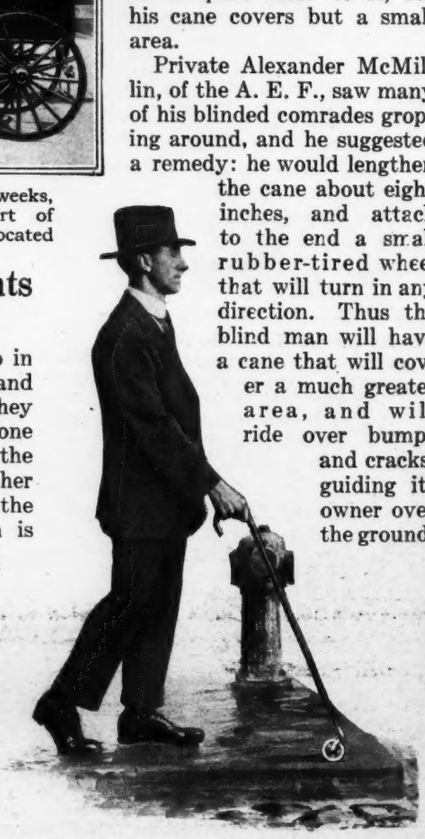
EVERY week or two a wagon draws up in front of an Indianapolis lamp-post, and two men jump out, carrying a ladder. They place the ladder against the post, and one man climbs up, takes off the globe, and hands it to the other man. He carries it back to the wagon, where a third man is stationed in front of a wash-tub in the wagon; the globe is duly washed and replaced. Meantime the man on the ladder cleans the lamp and oils the screw.

The wash-tubs are really not tubs at all, but milk-cans. They are filled several times each day with boiling water that is charged with a strong cleansing powder.

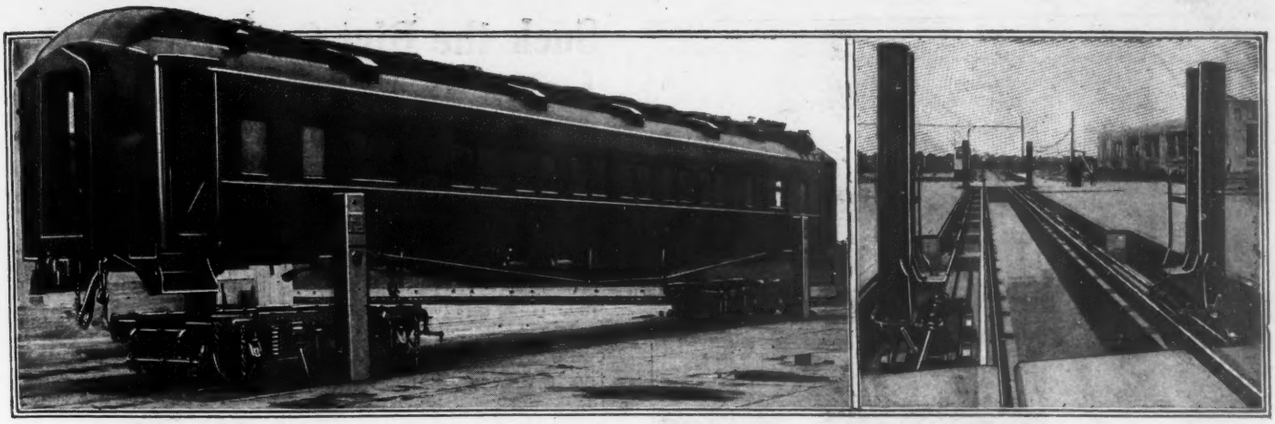
## Help the Blind by Improving His Cane

TAP, *tap, tap;* the blind man feels around with his cane. Is he near the curbstone? He cannot tell until he is quite close to it, for his cane covers but a small area.

Private Alexander McMillin, of the A. E. F., saw many of his blinded comrades groping around, and he suggested a remedy: he would lengthen the cane about eight inches, and attach to the end a small rubber-tired wheel that will turn in any direction. Thus the blind man will have a cane that will cover a much greater area, and will ride over bumps and cracks, guiding its owner over the ground.



A long cane with a small rubber-tired wheel on the end will guide the blind man



For raising coach bodies from trucks, four jacks—two movable and two stationary—are used; through them run two shafts having worms that connect with worm gears in the jacks; an electric motor starts things moving. As the shafts revolve, brackets on the jacks that support the body rise up and take the body with them

## Lifting Eighty Tons

BUMP, *bump!* One of the wheels of the passenger coach had worn flat. As a matter of fact, both trucks needed repair. To tackle the job properly the body of the coach had to be removed. How was it done? By means of jacks.

The coach was run along the track until the truck at one end was directly in front of a stationary pair of jacks; then two movable jacks were placed in line with the truck at the opposite end of the coach. The four jacks were adjusted by hand levers until projecting brackets rested just below the body of the car. Then the body and truck were disconnected and an electric motor started.

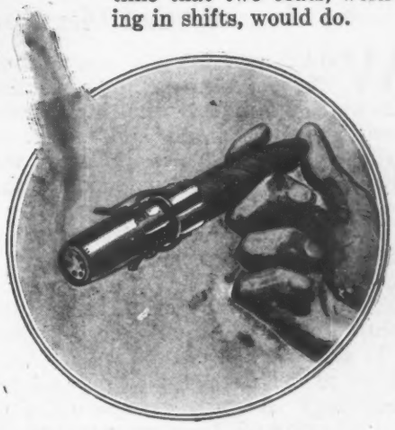
Slowly the body rose into the air. Magic? No; revolving shafts set in motion by the motor. These shafts are located on each side of the tracks and they run through the bases of the four jacks. Eighty tons may be lifted.

By changing the lining from silk to fur this coat may be used both summer and winter. The fur may be ripped out and silk substituted for it. We are not certain as to the object of this strange practice. The overcoat was made in Germany

## It's from Germany

EVERY cloud has a silver lining, but this uniformity does not hold true for overcoats. In fact, some overcoats have several different linings—one for each season of the year. Such an overcoat is shown herewith, lined with silk for summer wear in one picture, and lined with fur in the other. It was made in Germany.

And what is its object? Surely not economy; for one coat worn summer and winter will wear out in half the time that two coats, working in shifts, would do.



No ashes or sparks will fall on your clothes if you will encase your cigar in this metal protector

## Restoring Action to Stiff Ankles

ANKLES that have become stiff from sprains, fractures, or as the result of rheumatism or gout, may be limbered up and restored to mobility by properly regulated exercise. The simple apparatus shown in the picture was invented by a German early in the war, and was used with success by thousands of soldiers.

Daily exercise by means of this apparatus will in most cases restore the mobility and normal functions of ankle joints stiffened by injury or disease

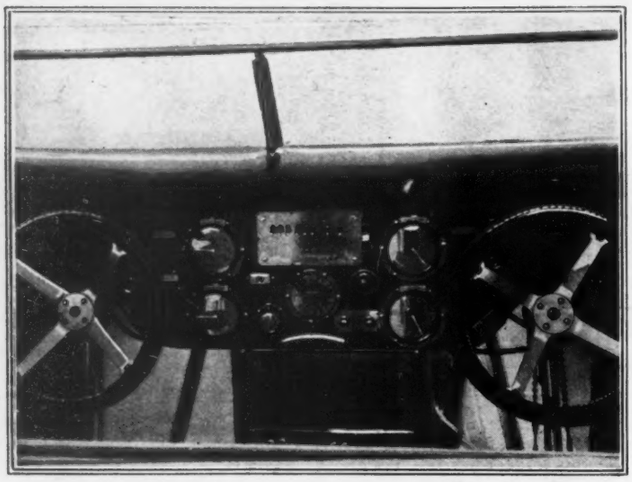
The apparatus has a foot-plate to which the foot of the patient is strapped. To an extension of the toe end is hinged a rod having at its free end a handle-bar. The foot-plate is supported at a point underneath, about three inches from the back of the heel, by a short post ending in a ball which fits in a socket of the base that rests on the floor.

By means of the guiding rod the foot-plate, with the foot securely strapped to it, may be given any rocking or rotary motion that may be necessary to restore the functions of the stiffened muscles and tendons. When the ankle is sufficiently strengthened and limbered up, the movements may be made without the assistance of the guiding rod.

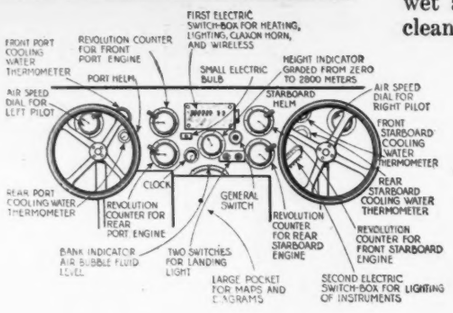
## For Cigar Ashes

"I WAS sitting in a smoking-car, puffing a cigar, when a quantity of ashes fell down and soiled my shirt-front; a spark burned a hole in my coat," Mr. B. W. Dedrick, of State College, Pennsylvania, tells us. There is nothing unusual about that; you have had the same experience many times. But did you promptly invent a cigar protector to prevent it happening again? That is what Mr. Dedrick did.

The protector is made of metal shaped like the cigar it covers. The end is perforated to admit the necessary air. It is held lightly in place by clamps. The ashes drop into the cylinder and remain there until removed.



The instruments for guiding the pilot are centralized on the dashboard. The pilot is strapped into his seat within easy reach of the instruments


FIRST ELECTRIC SWITCH-BOX FOR HEATING, LIGHTING, CLAXON HORN, AND WIRELESS
FRONT PORT COOLING WATER THERMOMETER
REVOLUTION COUNTER FOR FRONT PORT ENGINE
PORT HELM
SMALL ELECTRIC BULB
HEIGHT INDICATOR GRADED FROM ZERO TO 2800 METERS
AIR SPEED DIAL FOR LEFT PILOT
STARBOARD HELM
AIR SPEED DIAL FOR RIGHT PILOT
FRONT STARBOARD COOLING WATER THERMOMETER
REAR STARBOARD COOLING WATER THERMOMETER
REAR PORT COOLING WATER THERMOMETER
CLOCK
REVOLUTION COUNTER FOR REAR PORT ENGINE
GENERAL SWITCH
REVOLUTION COUNTER FOR REAR STARBOARD ENGINE
REVOLUTION COUNTER FOR FRONT STARBOARD ENGINE
BANK INDICATOR AIR BUBBLE FLUID LEVEL
TWO SWITCHES FOR LANDING LIGHT
LARGE POCKET FOR MAPS AND DIAGRAMS
SECOND ELECTRIC SWITCH-BOX FOR LIGHTING OF INSTRUMENTS

In the dashboard of a British airplane shown here some of the instruments are duplicated; this is because the machine accommodates two pilots

# An Airplane's Nerve Center

**By Carl Dienstbach**

WHAT must the pilot know about his airplane during flight? He must know the direction and velocity of the wind, the altitude, direction and speed of his flight, the position relatively to the horizon of the airplane in space, the cylinder pressure and performance of the engine or engines, the quantity of fuel in the tank, and the temperature of the cooling water.

The pilot must ascertain at a glance what is necessary for him to know, and instantly control the engine, ailerons, and rudder. Since he is strapped to his seat, means of obtaining this information and of controlling the airplane must be centralized within reach of his eyes, hands, and feet.

In all modern airplanes the various instruments and indicators, as well as the controlling switches, are located on the dashboard. A typical example of the modern airplane dashboard is shown in the accompanying picture. It represents the dashboard of one of the large British seaplanes with four separate engines. Some of the instruments are duplicated, because these machines are intended for two pilots sitting side by side and alternating in the control of the flight.

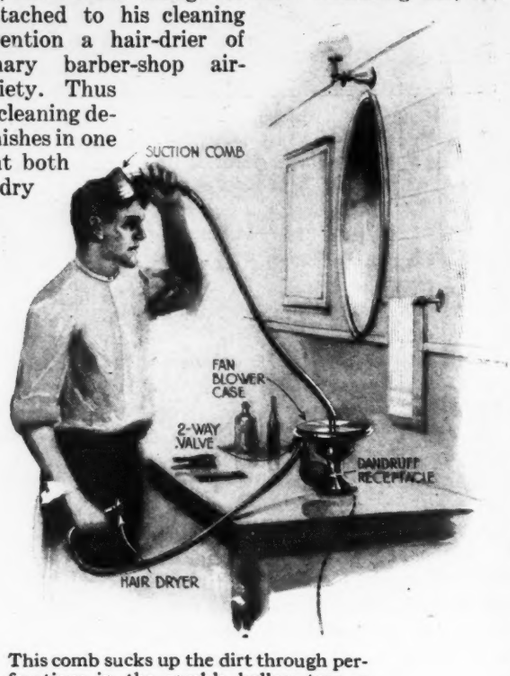
In the middle of the dashboard is the altitude indicator, reading to 2,800 meters (about 8,500 feet), the greatest height attainable by this type of machine. In front of each pilot is an air-speed dial, which indicates the speed with which the supporting air current strikes the controlling surfaces of the airplane. For each of the four engines there is a separate dial indicating the number of revolutions to 2,200 a minute, and another dial showing the temperature of the cooling water. Near the lower edge of the dashboard, between the two pilots, is the position indicator.

Among the control switches on the dashboard are those for lighting the various dials and instruments, for electrical light and sound signals, for navigation lights, and for turning on and off the current in the electrically heated garments of the pilots when they are exposed to the intense cold of high altitudes. There is also a clock, a two-button switch for the landing lights near the altimeter, and two switches for the radio apparatus.

# Suck the Dirt Out of Your Hair

INSTEAD of cleaning your comb, let the comb clean you —that is, your hair. Antonio di Salvio, of Washington, Pa., invented the hair-cleaning comb shown below. The comb is hollow, and has perforations above the teeth through which the dirt in your hair is sucked. A motor-driven fan causes the suction, after the fashion of the vacuum cleaner. And the dirt is likewise deposited in a receptacle within, after it passes through a tube.

Steady vacuum-cleaning may be sufficient treatment for dirty rugs, but it is not enough for hair. Realizing this, Mr. Salvio attached to his cleaning comb invention a hair-drier of the ordinary barber-shop air-blast variety. Thus his "hair-cleaning device" furnishes in one instrument both wet and dry cleaning.




This comb sucks up the dirt through perforations in the comb's hollow top; a drier for wet cleaning is also attached

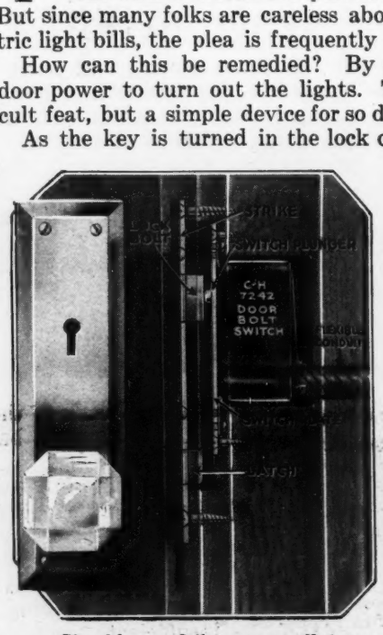
# The Bolt Turns Out the Light

"PLEASE turn out the lights when you leave the room" —the walls of hotels are plastered with signs like this. But since many folks are careless about other people's electric light bills, the plea is frequently ignored.

How can this be remedied? By giving the lock on the door power to turn out the lights. This sounds like a difficult feat, but a simple device for so doing has been invented.

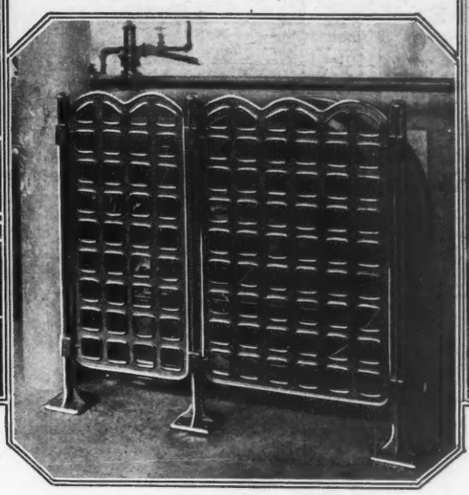
As the key is turned in the lock outside of the door, the bolt shoots out into its place in the door-jamb and forces back a switch button located there. Out go the lights; for wires connect the button in the door-jamb with the regular switch button on the wall of the room. When the guest returns and unlocks his door, the lights flash up again.

Since the switch button in hotel rooms is usually located near the door, very little wiring is necessary to install this automatic door-bolt switch.




Should you fail to turn off the lights when you go out, the door-bolt will do it for you

She must use both hands when she operates this die; in this way they are kept out of mischief



This iron fence comes in sections that may be fitted in movable posts; thus a fence can be built quickly around dangerous machinery when women work near by

All the movable parts of this drill-press wear armor-plate; this includes spindle, belts, and pulleys

# Guarding the Woman Machine Operator

THE ambulance clanged through the streets and drove in at the entrance of a large machine-shop; another workman had been caught in a machine. Not so many years ago this was happening every day. Then employers began to build guards around the dangerous parts of machines. Before the war, careless machine-shop accidents had nearly disappeared.

And then came the women machine operators, with their loose skirts, sleeves, and hair. Additional guards had to be built around the machines in many of the shops. Some of these guards are shown above. Take, first, the cast-iron fence, which can be moved from place to place. It is made in sections of various sizes having four small projections that fit into corresponding holes in the square iron supporting posts.

The swinging die is another safety device. In order to take a piece of work from the die and substitute a new piece in its place, the die must be swung out of the way of the punch.

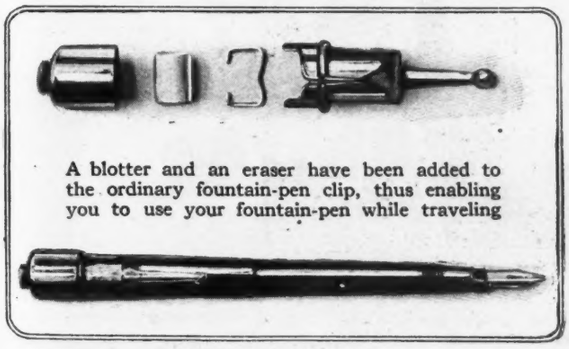
And now for the drill-press. Sheet-metal guards much like breastplates are placed over spindles, belts, and pulleys—the revolving parts of the press. Thus there is no chance of hair or loose clothing getting caught in the machine.

Statistics show that ninety per cent of industrial accidents result from preventable causes.

## A Spool of Blotter for the Fountain-Pen

"WHILE riding on a trolley car, I was sitting opposite a salesman who was writing with a fountain-pen; when he finished the sheet he waved it in the air till it had dried. This gave me an idea, and I worked out a revolving blotter to be made with the fountain-pen clip, all in one." This is what Mr. Jacob Goldstein wrote us when we asked him how he came to invent his combination fountain-pen clip.

The blotter is wound around a spool that fits inside the end of the clip. On the outside is a small eraser. The clip, which holds the pen in your pocket, may carry your name.



A blotter and an eraser have been added to the ordinary fountain-pen clip, thus enabling you to use your fountain-pen while traveling

It consists of three parts, the base, the clamping plug, and the screw-cap. The picture on the right shows the new insulator with the wire in place and properly fastened

## Fasten the Wire by Screwing Down the Lid

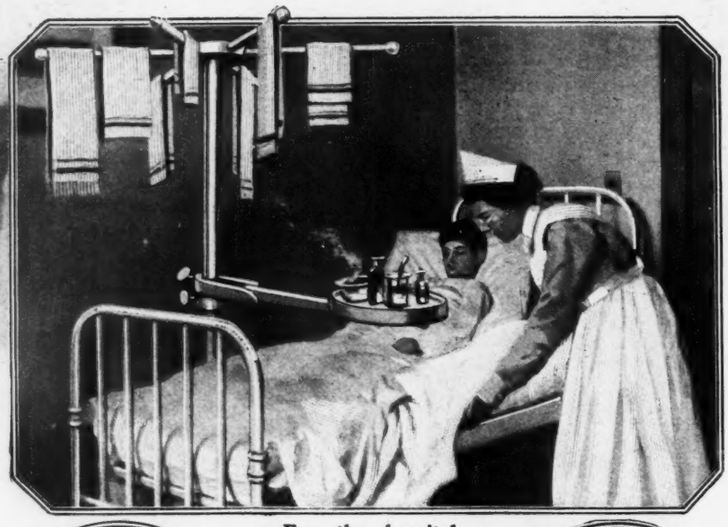
TELEPHONE and telegraph wires must be insulated to prevent loss of electric current. The insulators in common use are of glass, porcelain, or some other non-conductor. The wires are fastened to these insulators by tying them to the non-conducting knobs with loops of wire.

The British Post Office Department has adopted a new kind of insulator, which is in many respects superior to the insulators formerly in use. It consists of a cylindrical base of a non-conducting composition, with a split head which has an outside thread fitting the inside thread of the screw-cap by which the base is topped.

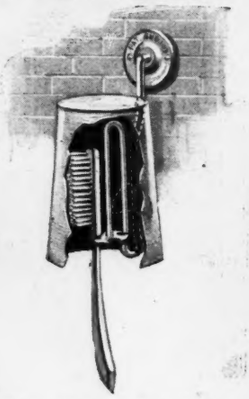
The wire is placed in the slot of the insulator, and a molded block of the same material as the base of the insulator top is fitted into the slot and the top screwed down. It bears against the clamping block and, as it is screwed down, presses it with great force against the wire resting in the groove provided for it. The grip is so firm that it is impossible to release the wire by pulling without breaking it.

# Taking the Drudgery from Housekeeping

The electric water-heater gives a small quantity of boiling water in a few seconds. The apparatus is fastened to the wall and occupies but little space



For the hospital and sickroom comes this combination tray and towel-rack. In operations the tray serves as a support for surgical instruments, while the rack holds the bandages



This glass tooth-brush holder has all the advantages, without the disadvantages, of the ordinary tooth-brush holder. The glass acting as a shield keeps out the dirt

A new-style vacuum cleaner has neatly concealed in its handle a small oil receptacle, always ready for use by simply and easily unscrewing the handle-cap

The combination wire dish-cloth and pot-scraper loosens the closely clinging mass at the bottom of the pan, while the wire rings tear loose every little particle

When you finish sweeping, invert the broom and catch the dirt in the dust-pan attached to the handle

This double-decker tea-tray facilitates the serving of several guests at a time

Here is the latest in market baskets. The cane in the center of the basket allows the load to rest while the shopper greets her friend on the avenue

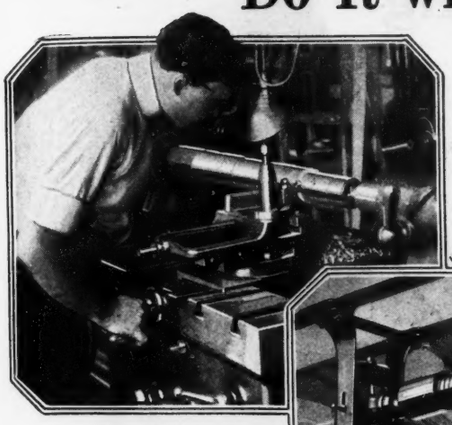
A new porcelain cutting dish has a removable board at one end for slicing meat, bread, or cake

A new device for lightening the task of cleaning carpets or rugs consists of two upright adjustable frames. The rugs are spread apart to give air space

For squeezing out fruit, vegetable, and other juices comes this brand-new kitchen utensil

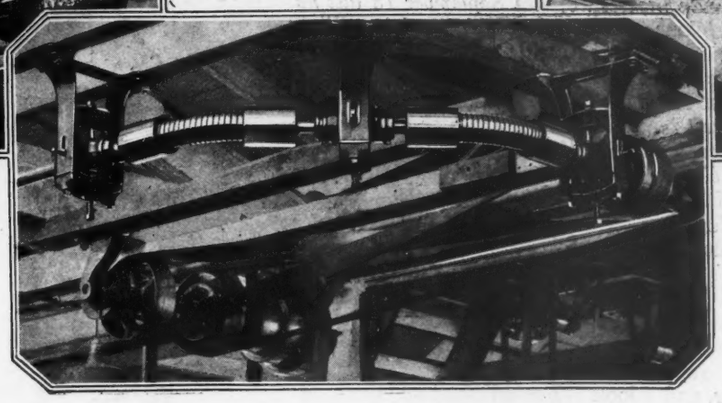
# Do It with Tools and Machinery

## Several devices that help speed up production



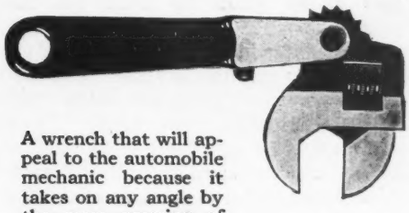
Intended for light production and tool work, the device is adjustable to any angle up to ninety degrees right or left. The spring gives a smooth cut

How magnetos are tested. The cam to be tested is slipped over a shaft rotating on a breaker mechanism and having the large disk secured to its rear



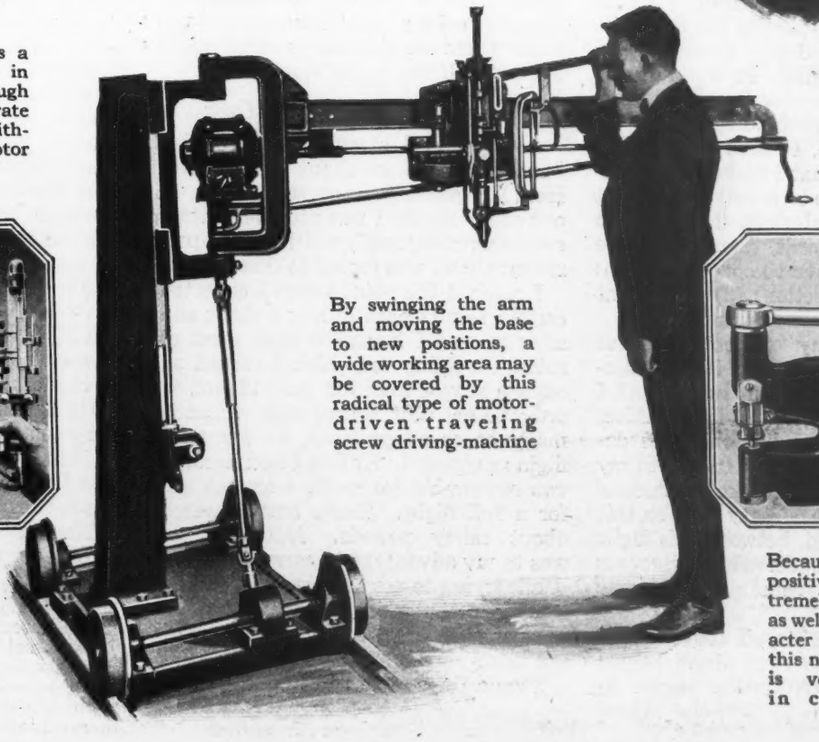
The full flexibility of this coupling permits a shafting to be carried anywhere. Contractors can run it around corners or over walls; it will carry power around a break while repairs are being made

This machine, which has a capacity up to 9/16 inch in steel, will drill a hole through any machine steel at the rate of 1½ inches a minute without overloading the motor

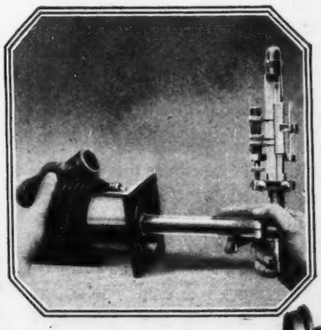


A wrench that will appeal to the automobile mechanic because it takes on any angle by the mere pressing of a button in its handle

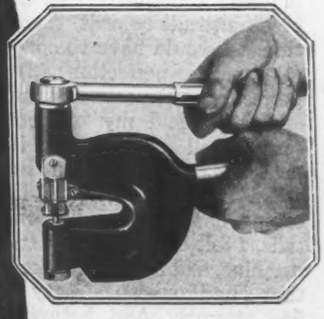
It cuts clean round holes in steel, slate, or fiber, and may be used in any position, on the floor or overhead and on the work-bench



By swinging the arm and moving the base to new positions, a wide working area may be covered by this radical type of motor-driven traveling screw driving-machine



A gage for testing the bore of automotive cylinders. To accommodate it to various cylinders, additional plugs, etc., may be added outside of the fluid-chamber



Because of its quick positive action and extremely light weight, as well as for the character of work it does, this new speed punch is very economical in cutting metal

# Hitting the World's Ceiling

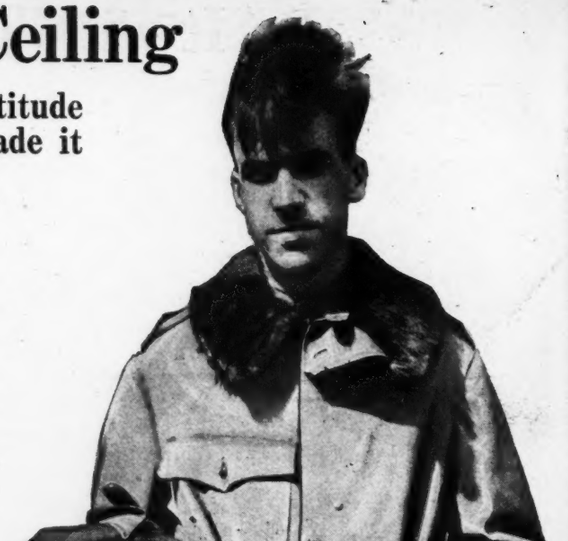
## How I planned and worked for the altitude record and how I felt when I really made it

**By Roland Rohlfs**

ROLAND ROHLFS, *who writes for the* POPULAR SCIENCE MONTHLY *the story of his great altitude flight, is not only "the man higher up": he is the man highest up. On September 18 last he pushed his 400-horsepower biplane to 34,500 feet — the world's ceiling. Rohlfs, who is a son of Anna Katharine Green, the novelist, is twenty-seven years old. He has been in the flying game for three years and is now a test pilot for the Curtiss Airplane Company. He is married and Mrs. Rohlfs takes great interest in her husband's sky-high activities.*

*The most noted altitude records that Rohlfs outdid are those made by Major Rudolph Schroeder, U. S. A. — 28,900 feet, made on September 18, 1918, in a Bristol biplane — and Adjutant Casale — 33,137 feet, made in France last May.*

*It is interesting to contrast the greatest height to which men have ascended above sea-level with the depths to which they have descended below it. In raising the submarine F4 off Honolulu several years ago, United States Navy divers went down 300 feet, the greatest depth which men have dared. Rohlfs went more than six miles up in the air.*



Roland Rohlfs displaying the latest thing in fashions for the man higher up. In making his record climb of 34,500 feet Rohlfs wore a suit, or rather several suits one over the other, to keep out the intense cold, a special pair of half-inch thick felt gloves of his own design, and a helmet planned not only to protect his face, but to administer the oxygen without which an aviator at 34,500 feet would die like a fish out of water

NOW that it is all over, and I look back on the number of high flights I made and the thrilling experiences I passed through, I wonder how I ever got up courage to go on after my first real taste of the danger. It was on one of my first flights that, on reaching 26,000 feet, I experienced a dull headache. I thought it was caused by the noise and excitement; but when, a few minutes later, things began to blur and a wave of dizziness swept through me, I realized that I had gone too far with a faulty oxygen apparatus. The next I knew, I awoke from unconsciousness to find the machine plunging downward at a terrific rate. I was frightened; for the machine had gained such headway, I was afraid that, in leveling off, some part of the structure might collapse and put a sudden end to my altitude flying. It was a great relief to me to be able to pull the machine out of its first predicament.

To my surprise, I found, on consulting my aneroid, that I had dropped 10,000 feet in a state of coma; and at that moment I decided that, if I were to break altitude records, there were three things I would have to concentrate on: (1) machine perfection; (2) equipment perfection; (3) personal fitness.

First, I had my oxygen apparatus tested, and found it had been undermeasuring, so I set about learning all I could of this important item. After taking one apart and learning its details, I felt better. I next turned to my machine, and began to make the changes that I had found necessary even on this first attempt. And, between this flight and my next, I underwent a vigorous set of exercises, including a six-mile walk each day.

I made eight flights, all above 26,000 feet, four of which were above 30,000 feet, and numerous smaller jumps to bring all the details to the point where I could count on favorable results beforehand. Problems were encountered in the motor operation, due to the extreme temperature and rare air conditions. Large funnels had to be made to reach out and collect as much as possible of the light air and force it into the carburetors. Far smaller gasoline jets had to be used than for normal flying, and more spark advance supplied than usual. Great care had to be exercised to be sure no leaks developed, and the oil and gasoline consumption was calculated after each flight.

On the final run I was to have only enough fuel to carry the machine to its absolute ceiling* and return it to the point where the circulating water would not freeze if the motor stopped.

### *When the Clouds Turn Over*

After several attempts I succeeded in working up to about 30,000 feet. Here I began to get new sensations. In one of my flights I was attacked with a severe yawning spell, which was so persistent that I was forced to descend.

I reached the point where I expected certain results both during a flight and after it, and I began to form a set of rules. In flying very high I turned on oxygen sooner than for short flights, in order to get accustomed to it. I made many other adaptations, as my trial flights suggested. At first I had to carry two oxygen-bottles to have enough gas for a full flight. These bottles weigh about thirty pounds. Naturally, it was to my advantage to carry only one. While trying to use less oxygen I gained a world of knowledge as to its use, at the same time discovering the danger of not using enough.

Should the supply run low, the aviator, if he does not recognize the symptoms, may easily become unconscious. He is first of all attacked by a dull headache; then the surrounding sky appears to grow dark; if the sun is in sight it seems to be behind a mist. Gradually these symptoms grow more acute until he reaches the stage where the clouds appear to turn over. At that point, if he does not turn on more of the life-giving gas, he will become unconscious.

*The highest point to which my machine could attain.

### *Could I Break a Record?*

I soon began to gain confidence as to my chances of breaking a record. I was nearly satisfied with my clothing and instruments, and the motor was showing improvement every time I went up, while I was just able to hold my own in physical fitness. I had selected my clothing as follows (everything being put on over my regular clothes):

3 pairs heavy hunting socks.
1 pair heavy wool-lined knee-boots.
2 wool sweaters.
1 pair wool trousers.
1 complete teddy bear, wind-proof, fur-lined one-piece suit.
1 wool-lined chamois helmet.

1 fur-lined leather helmet.
1 goggle face-mask.
1 oxygen nose- and mouth-piece.
1 pair combination finger-mitt aviation gloves, used with 1 pair half-inch thick felt gauntlet mitt gloves.

### *A High Climb*

So, with everything as I wanted it, I started, July 24, 1919, on a high climb. In one hour and fifteen minutes I found myself at 29,000 feet. I realized that I was climbing too slowly for the fuel I carried, but I was spurred on by the fact that I had passed the official world record mark, and so con inued to collect data. The earth was hardly visible; all I knew was that I was above land, and I hoped it was Long Island. I finished the rest of my climb in twenty-eight minutes, and reached 31,000 feet.

My head began to feel big and I was growing cold. I nosed over and began my descent. I was greatly surprised to find that I was east of Montauk Point, over the ocean, though I had been headed west. So strong had been the wind at that height that I had been continually forced backward. My motor stopped from lack of fuel, as I had anticipated, so I was forced to land fifteen miles east of the home field to get oil and gasoline.

While waiting for supplies, I went over in my mind the points I had learned. First, I decided it was very easy to get lost, and with the ocean so close it was a dangerous thing to play with. I felt sure that the ideal way to make a high climb would be to get up to the top as quickly as possible, and stay there as short a time as possible; for on taking off my clothes I discovered the veins in my arms to be swollen. My heart, too, was beating more strongly than usual. I began to wonder whether the game was worth the candle. But on looking at the barograph I grew very excited; for, at the moment of stopping, the machine had still been climbing well. I had not reached the ceiling. Yet on this flight I had gone beyond the world's official record of 28,900 feet.

On July 31 I again tested my chances of hanging up an official record. All the necessary men were on hand to witness this attempt. Little did I realize what I would have to go through. The trouble began on the ground, for the motor would not start well. But I thought that, once up and away, the motor would settle down and do its duty, and away I went.

Ready for the start. The helmet, provided with oxygen nose- and mouth-pieces, give him the appearance of a deep-sea diver, and Rohlfs in making a world altitude record found it as dangerous to come down too rapidly as a diver does to come up out of the water too fast

### *Motor Trouble*

On reaching 22,000 feet my trouble again began. The motor was fully two hundred revolutions under what it should do. This was caused by a new type of high test gasoline I was using and by the fact that the water in the radiator was cold. I tried to reach forward and cut one of the pressure water-hose connections, hoping that by letting out a quantity of water the remaining amount would reach a higher temperature. I had to take off my safety belt to reach this pipe, and, with the machine pitching around, I could not accomplish my purpose. I mounted higher, but only to find the motor getting still colder. I took my cushion from beneath me and ripped it open with my knife. Removing the hair padding, I tried to wedge it in between the tubes of the radiator to blank off some of the cold air rushing through. But again I was unsuccessful; the wind tore the padding away as fast as I put it in.

By this time I was so tired that I could hardly decide what to do, when to my disgust the motor began to miss, and I noticed the gasoline pressure had fallen. Almost instinctively I began to pump gasoline by hand and so kept the motor going. Occasionally the motor-driven gasoline pump would do its work and relieve me. Suddenly I found myself being blown out to sea. I shut off the throttle and started down. I came down altogether too fast, and as a result was laid up for two weeks.

### *I Had Struck It at Last*

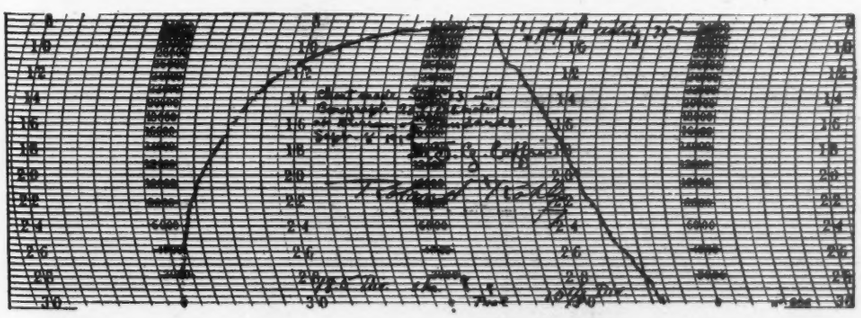
I had reached only 30,700 feet, not so high as I had been before. But what I had lost in distance I had gained in experience, for I now saw how I could increase my climb many thousands of feet. In my sick-room I went over the points gained.

After improving many details, I again, on September 5, took to the air for a short test. I had struck it at last — a combination of details that worked. So terrific was the machine's climb that I reached 26,000 feet in twenty-six minutes — better than I had ever done before. But my teeth ached badly and I grew very weary under the quick change.

I was elated over this climb, although it was only a thirty-minute one. I studied the charts for a long time to determine whether I could afford to call the officials. The triplane machine reaches its ceiling at an abrupt angle and will go no farther, and this decided me to make one more test flight.

On September 13 I made ready for a real climb. It seemed only a few minutes before the earth became indistinct. Soon I reached the 32,000 mark. Then a sense of loneliness swept over me, and I suddenly realized that I had never been up so high before. Out of the mist to my left a small balloon drifted by. I was startled at first by the sight of it, when I thought I was all alone; but I immediately recognized it as one of the observation balloons daily sent up from Hazelhurst Field to test air conditions.

Above 32,000 feet climbing became difficult. My head ached and so did my stomach. While I was writing data, the machine got over into a bank, and in trying to bring it back I discovered that my ailerons would



High-flight records rest on the testimony of the barograph. This typical record portrays graphically one of Rohlfs' test flights, in which he reached an altitude of 34,200 feet. The curve shows the progress of the machine; first a steep climb to 6,000 feet, and then a "flattening out" to the top of the climb. The first column of figures on the left indicates barometric pressure and the second column the measurement in feet

not move. The machine had been washed several hours before the flight, and no doubt some of the water had frozen in the hinges. I tried to keep up my data, but had to stop

### *The "Temperature Lid"*

The cold was intense, reaching 44° below zero F. at 34,000 feet, while at 34,200 it grew four degrees warmer, or 40° below zero. This is extremely interesting, for it is believed that above a certain height the temperature stops getting colder and begins to get warmer. This changing point is called by scientists the "temperature lid."

Soon I reached the limit — and none too quickly, for I had been running under a cut supply of oxygen. Remembering my past experiences, I descended very slowly, and I am sure this alone had a great deal to do with my being able to tackle my last and highest climb five days later. Knowing that I could beat all records, and that one more attempt and I would be through with work of this nature, made me happy. I began to make final preparations.

I went over the entire machine to see where I could save weight. I removed the fire-fighting apparatus, floor-boards and braces, oil thermometers, and other instruments I could do without. I decided to carry nine gallons less of gasoline and one gallon less of oil, and so on, until I had lightened the machine by ninety-five pounds. As for the oxygen supply, I found the machine now climbed so fast that I had oxygen to spare even with only one tank.

### *I Call My Witnesses*

On September 18 I called the judges to witness my last attempt. Everything was ready early in the day, and each mechanic knew just what to do. After setting and sealing the two barographs, I dressed with the utmost care. I had determined to take only the data necessary to make the record official; t' 's consisted of two temperatures at every 2,000 feet — one of the outside air and one of the air close to the barographs. It is by the temperature of the barographs that the final results are computed.

All in readiness, I climbed aboard. Without the slightest delay, I took to the air and climbed rapidly toward the east. To hear the motor, one would think it knew this was to be its big chance. The revolution-counter showed it to be turning twenty-five more revolutions to the minute than ever before. Determined to win, I used every trick I knew to shorten my time and heighten my climb.

The day was perfect, the visibility one hundred per cent. The earth seemed to stand out in living colors. Soon I reached the 31,000-foot level, and here I experienced the only exciting incident of the flight.

Since I had removed most of my instruments to save weight, I had to rely on instinct to tell whether I was flying correctly. I had just finished writing my temperature at 31,000 when, on looking up, I found that the machine was slipping sidewise to the right. With my controls I corrected it, but then, to my astonishment, I started to slip to the other side; and after correcting that I proceeded to fall again to the right.

I was angry as well as puzzled, for I had lost six hundred feet in the series of slips and dives; and since I had counted on seventy-five minutes for my climb I was afraid the gasoline would give out. I supposed that while writing the machine had started climbing too steeply, had slowed down to the point where it was about to stall, and since it did not have enough forward speed to climb the grade it had assumed, started slipping first to one side and then to the other.

### *Would the Gasoline Hold Out?*

I changed my angle, and the machine straightened itself out and started once again to climb toward the heavens. From here on nothing of importance happened, except that I discovered the wind was blowing very hard in the opposite direction from what it had been on leaving the ground. I proceeded to change my course, heading due west. I was now about over the center of Long Island at 33,000 feet, and I had only a few minutes more to climb. My only worry was as to whether the gasoline would last, since I had lost six hundred feet. The temperature was intense, reaching 43° below zero; but I had no time in those last few minutes to think about the cold.

I passed the 33,136-foot mark, and was still climbing. No time for lonesomeness now. I used everything I knew to hasten the climb, and in seventy-five minutes I reached 34,400 feet, or higher than my previous record. Should I go down? Surely the gasoline must be very low, and I needed enough to run the motor through the freezing air in descending till I reached the warmer levels to prevent it from freezing solid and ruining that wonderful motor. I decided to go three minutes more and then descend.

As I reached my peak I glanced at my instruments, and, to my delight, they read 34,500 feet, and also showed I had reached my ceiling. After writing the two temperatures I began my descent, coming down in thirty-five minutes.

I had succeeded, and the earth, as it came into view, looked very beautiful to me. I could just make out my landmarks, and there in the distance was the field I had started from. The pressure of air on my body made me very uncomfortable, and my head seemed to fill with it; but by swallowing continuously I fought against the sensation and kept my head clear.

### *No One Knew But Me!*

There they were, the spectators who were awaiting my return. I smiled to think of what they did not know and were waiting to hear. No one knew but me! For the minute I was master of all I knew. But it was with a great deal of satisfaction that I told them of my success.

Since my starting-place had an initial height above sea-level of 110 feet, this was added to my indicated height on the barograph of 34,500, making the total 34,610 feet.

This ends my altitude experiences, for which I am duly thankful. A great deal of valuable data was collected; but the most interesting, from the point of view of the public, no doubt is the possibility of constructing machines to fly at high altitudes so as to use the high-velocity winds of the upper level. By riding these winds in the right direction tremendous speeds can be obtained, and the value to transportation can be imagined when it is realized that one could easily travel from America to Europe in twelve hours.

In this *Wasp* triplane, equipped with a 400-horsepower motor, Roland Rohlfs on September 18 last soared to 34,500 fe t—higher above the earth than man ever went before

# Heaving the Log in the Air

## Airships borrow a device from their sea sisters to help them find the way

By Carl Dienstbach

THE recent more or less successful attempts to cross the Atlantic by airplane have taught some highly important practical lessons and have contributed to science extremely valuable information. They have taught, among other things, that fog, combined with thick weather and rain, makes the usual method of land flying at an altitude of from 4,000 to 5,000 feet impracticable for crossing the ocean. The pilot must either go very high, so as to be able to guide himself by the stars or the sun, or he must fly near enough to the surface of the water to see clearly how his machine is moving with reference to that surface.

Observations made at high elevations and from a fast-moving airplane are liable to be inaccurate because they are based upon an artificial horizon. The use of such a makeshift is necessary in view of the fact that at a high level the true horizon line becomes faulty.

The Vimy-Vickers flight has shown that a fair measure of accuracy may be obtained by keeping a close watch on the surface of the water at short range. Ireland may well be reached that way, but it is doubtful if some small island in mid-ocean could be found in a similar manner.

The question suggests itself: Why may not dead reckoning be made mathematically accurate by logging the water from an airplane just as it is done from the taffrail of a sea-going ship? There seem to be no mechanical difficulties in the way of using an appropriately shaped "patent log" to great advantage in trans-oceanic flights.

The patent log, of which there are several types, consists of the log proper — a metallic rod with spirally arranged fins, which cause the log to rotate when it is dragged through the water at the end of a line. This line, usually between 400 and 600 feet in length, consists of a specially woven rope which transmits the rotations of the log to a flywheel connected with a revolution-counter. This is so calibrated that its dial indicates the forward motion of the ship in tenths of a mile upon its dial. Of course, the number of turns of the log necessary to make one tenth of a mile is determined in advance by practical tests.

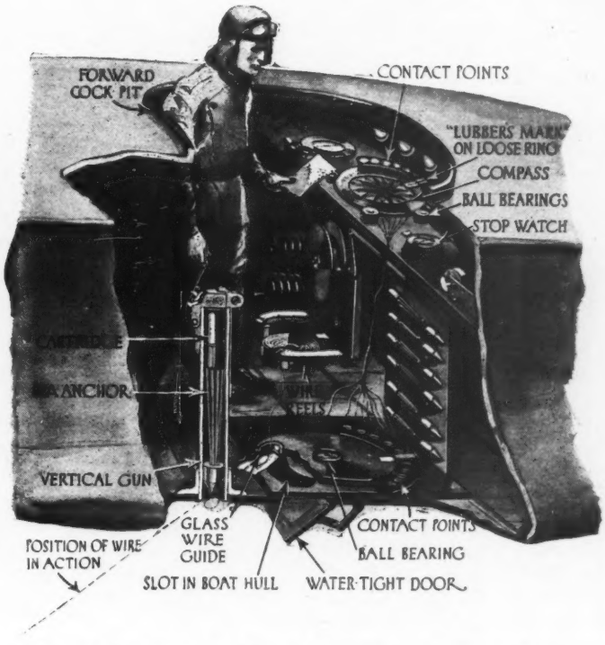
By means of the patent log the navigator of a low-flying airplane determines not only his speed but also his direction of flight. The speed indicated by the log, as it is dragged through the water, coincides with the speed of the airplane; it can be read off from the dial of the rotation-counter. The direction in which it "taxis" behind shows precisely in which direction the airplane, under the combined influence of its own speed and the side drift due to the wind, moves over the surface.

Any serious error is scarcely possible. It would be comparatively easy to devise an instrument that would register graphically on a chart like a barograph, the direction and speed of the flight. It would thus become an automatic navigator. The chart would be a map of the ocean and upon it the needle of the instrument would trace the path of the flight.

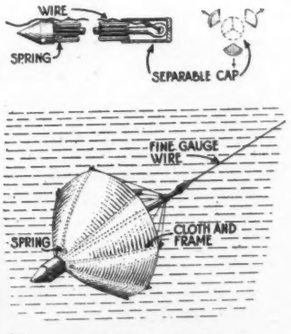
The greater the speed of the airplane, the greater the difficulty of keeping the log propeller in the water, the longer must be the rope by which it is dragged. The pull of a long line dragged through the water would cause a diminution of the speed of the airplane, and this is undesirable in a long flight in which every minute and every mile counts.

Extremely fast airplanes might use an adaptation of the old system of taking the log which was in use before the patent logs were invented. The old-style log consisted of a wooden quadrant, weighted at the periphery to keep it in a vertical position and retard its movement through the water. This log was fastened to a long line of a known length, marked at intervals of 47 feet 3 inches. The line was wound upon a light running reel. When the log was to be taken, the wooden log chip was heaved overboard, and, by means of a sand-glass timed for 28 seconds, the length of the line was measured which had to be paid out from the reel in that interval. This gave the distance covered by the ship in a given time in nautical miles.

For use by an airplane the log chip might be reduced in size. It might be attached to a thin wire which could be cut loose and sacrificed after it had served its purpose, together with the log chip. The log chip might be preferably of the form of a small harpoon, which to place it in the true wake must be shot into the water in a vertical direction from the airplane, flying as close to the surface as possible. The log could be so constructed that it would open in the water like an umbrella, forming a kind of water anchor. By means of a stop-watch or an automatically working time micrometer, the exact time consumed in reeling off a given length of wire could be ascertained. The direction of the pull of the log wire would indicate the side drift with accuracy.




With his hand on the trigger of the vertical gun, the aviator is about to fire the parachute-like sea anchor into the water, to determine the speed and drift of the seaplane




The parachute of the log opens in the water and acts as an anchor for the fine steel wire which is unwound from the reel as the seaplane skims

# When Ships Go Down to the Sea

## This new harbor-entering system may do away with the shipping delays now caused by fogs

**By Lloyd E. Darling**

*MOO-OO! Moo-oo-oo-oo-oo. Moo-oo-oo-oo-oo-oo-oooo-oo. Blaw-aw-w-w-w. Bler-bler-ee-e-e-ee-e. Bleep!*

If you live inland, it will be difficult for you to imagine the great orchestra of whistles that sound out over the waters of a busy harbor on a foggy morning.

Every ship is saying, in effect, with its whistle:

"Here I am. For the love of all that is good, move carefully with your old tub, and don't bump into me. I'll try not to bump into you. We both must be careful this morning, for we cannot see ten feet ahead of us.

"I cannot very well be anywhere else than where I am. This fog descended suddenly—there was no time to get to a better place. On one side of me are the reefs and shallow water of the harbor's edge; on the other, the channel. If you *must* move, stick to that channel—if you don't, there are likely to be two funerals, yours and mine. This will be sad—exceedingly sad—for both of us.

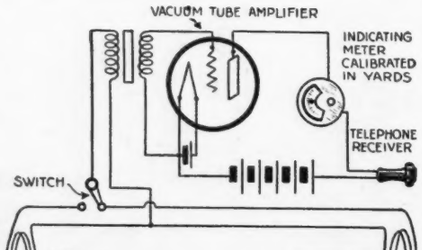
"As for myself, I'm a big ship, and I'm being held up; but what else can I do? If I plowed up the bay in all this fog this morning, there would likely be half a dozen holes and dents in my sides from the tug-boats and other craft my big bulk would run down. No, sir. I stay right here. *Moo-oo-ooo-oo. Blaw-aw-aw-aw. Er-ee-ee-ee*——"

### *Self-Defense by Whistling*

This is a fact. About all that most ships have to defend themselves with in a fog at present are their whistles. And they do use them, most thoroughly.

Far out over the most distant waters of the harbor sound the low moans of the biggest ships; near at hand the high-pitched, staccato notes of the forever-arguing tug-boats carry on a tumultuous chorus.

It is an exhibition of a situation that unwonted clumsiness on the part of man, and lack of a particular kind of inventiveness, have put him into. Though he may be past master of himself in many fields of invention—ships, railroads, manufacturing, what not—such a little thing as a fog bests him completely. He is completely outdone, shown up, helpless. Far from showing his usual buoyant resourcefulness, he is as lost as a lost child.




Circuit by which an operator aboard ship listens in on radiations coming from a submerged cable

This is true even on land. On railroads the most serious wrecks usually occur in fogs. On busy city streets the narrowest escapes from being run over occur in heavy rainy or foggy weather.

Earl C. Hanson, a young investigator in radio lines, has thought of one of the most practical methods of dealing with fogs yet devised. What he has had in mind was chiefly the needs of ships entering harbors, but his idea is capable of being applied also to other situations of similar character. Few plans yet proposed have been so simple and yet had so many elements of practicability.

The idea, which may possibly be put into practical service in New York harbor and elsewhere, is a ramification of the audio-frequency system of communicating without wires, of which Hanson has been an ardent sponsor for some time past. Its application to the dispensing of music wirelessly in hospitals was discussed in the September number of the POPULAR SCIENCE MONTHLY.

Under this plan, as applied to ships entering harbors, older ideas, such as laying a steel cable in the channel and dragging a rope over the stern of the ship with a pulley tied to it, are done away with. This one uses an *insulated*—heavily insulated—cable laid in the channel. There is no physical contact with the cable at all. A 1,000-cycle potential is impressed upon the cable at the shore end. This radiates an electromagnetic field. Another cable, some distance from the first to the right or left, also runs out of the harbor. This cable is for ships going in the opposite direction. A 500-cycle potential is impressed upon this cable. Both are grounded at their outer ends.

### *How the System Works*

Coming up the harbor, a ship is equipped with coils of wire attached to its sides in the manner made clear in the illustrations. These are connected with a vacuum-tube amplifier as shown in the diagram. A two-point switch enables the operator to change from one coil to the other at will.

He listens in as the ship slowly plows its way up through the all-enveloping vapor. The rail of the ship can hardly be seen a few feet away—let alone another vessel any distance out.

Suddenly he hears a high-pitched note in the receivers. Ah, the ship is getting

No longer will progress in a fog through the hundreds of ships habitually in this part of New York harbor be difficult. The cables shown in the picture will, by electrical means, guide incoming and outgoing traffic in safety

near one of the cables! Fainter, farther away, comes another hum. This hum, lower in pitch, is the other—the 500-cycle—cable. Very well. The ship is all right the way it is, for the high-pitched 1,000-cycle cable is the ingoing cable, the one it wants to follow up the harbor. Outgoing ships are to follow the other, in this way keeping the traffic separated and preventing collisions. Listen to the operator:

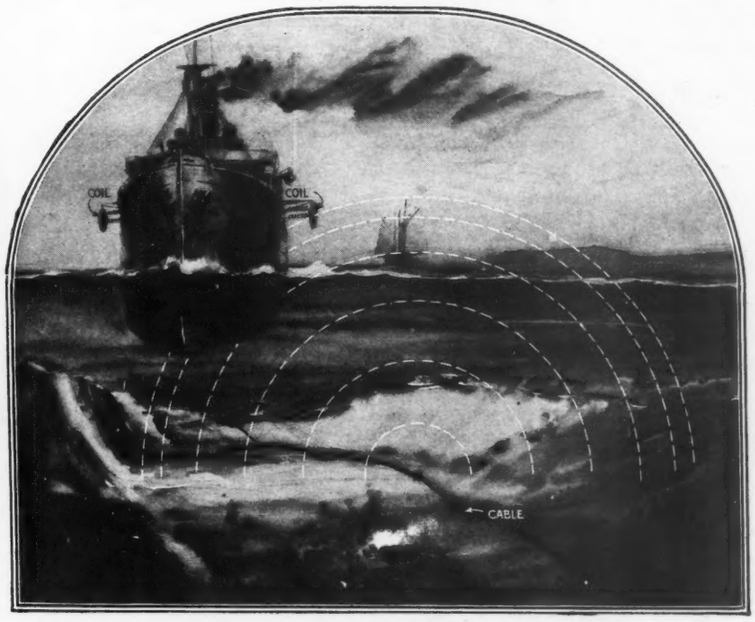
### *Directing Pilot*

"Hey, pilot, throw her over to starboard a little. We are passing the cable—getting too far to the *other* side. I can tell by the way, when I throw this two-point switch over, the hum now comes in on the other coil from the one it did. If we *weren't* clear across the cable, the hull of the ship would prevent the hum (or rather electro-magnetic radiations from the cable which cause the hum) from reaching this other coil. So turn back—we'll be straying off our path if we aren't careful."

It is by this listening in on first one coil and then the other (by throwing the handle on the two-point switch back and forth) that the operator tells on which side of the cable his ship is proceeding. Of course, the cable is far beneath the ship, submerged in the waters, and there is no physical connection (rope, chain, or the like) between ship and cable. The 1,000-cycle current impressed on the cable merely gives off radiations that are capable of producing a corresponding pitch in the operator's receivers when the coils at the sides of the ship pick them up.

The same is true, of course, of the 500-cycle cable, whose correspondingly lower-pitched note is guiding ships in the opposite direction.

A section of iron sheath, placed at mile or other convenient intervals, prevents radiations from the cable from passing out. When passing over these shielded places, the operator can hear no sound for the moment, and he therefore knows that he has gone by a marker and that he is in consequence that much nearer his goal. By checking off these markers on a map as he passes each one, he is able to tell exactly where he is in the harbor at all times—even though both darkness and fog surround him.




The hull of the ship, being metallic, shelters the off-side coil from the cable's radiations. The ship's operator can thus keep track of her movements from one side to the other of the cable, by simply shifting his two-point switch

### *Audio-Frequency Currents*

Technically, an interesting feature about the idea—beyond, of course, the general plan of getting a ship into a harbor in this way—is the application of a vacuum valve to amplify audio-frequency currents. Audio-frequency currents are those you can hear in a telephone receiver without first some form or other of rectification to direct current being used.

Audio-frequency currents run up anywhere to about ten thousand cycles a second. The upper limit is that of the human ear. Beyond that you get into the realm of radio-frequency currents. The ear cannot hear these at all unless their rapidity of vibration (cycles per second) is reduced. A vacuum valve is ordinarily employed for this purpose. But in the Hanson audio-frequency system the currents are already audible. The valve merely serves as an amplifier.

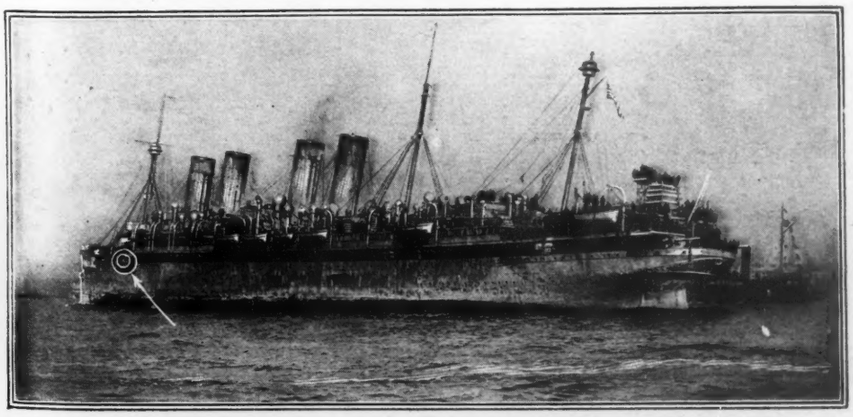
### *Use of Amplifier*

So ample are the currents generated that it is possible to operate an indicating meter in the same circuit as the receiver. This meter is calibrated in feet, automatically indicating how far the ship is away from the cable at a given instant. This would hardly be possible without the amplifier, and its use in connection with the remainder of the appliances proves a happy combination.

A variant of the harbor-entering idea employs but one cable laid in the channel instead of two. This would save expense. Inbound ships would keep themselves at a considerable distance to one side of the cable, and outbound vessels would follow the other side. It has been proved that this is practicable; for, in certain tests, signals have come in to operators aboard ship so loudly that they were easily followed. Further experiments will doubtless develop other practical variations.

Congestion in our harbors is one of the principal reasons why shipping costs are so high. It is often more expensive to get a shipment of freight unloaded from railroad cars in the neighborhood of New York harbor, moved across the piers and docks, and loaded aboard ship, than afterward to transport the same freight on the ship to South America. One material reason for this greater expense is that costs pile up while the goods are lying around on piers and in neighboring warehouses waiting for ships to get in.

Any harbor-entering system that will enable vessels to get to and away from their destinations with facility will have a large field for usefulness. We may expect much development in this line in the near future.



A side view of the ship above, showing how the receiving coils are to be affixed to the sides of liners and other ships. The apparatus is easily installed

The pupils in this class actually make models of the many things they learn of. Here you see two boys assembling a baby airplane, thus getting a practical knowledge of flying

## Building Things They Study

GEOGRAPHY, mechanics, economics—how can you interest the unwilling schoolboy in these subjects? To answer this question, you must discover first why he is unwilling. It is chiefly because he must constantly curb his naturally active nature while in the class-room. Then why not let him *do* something — make the things he learns about?

This scheme has been put into effect in the St. John's Boys' School at Ealing, England, by Mr. E. J. Golledge. Here you see a class of boys studying about the airplane while two students are taking their turn at assembling a model airplane.

On the floor of the class-room is a wood-and-water world, the continents and islands being represented by blocks of wood. Small ships sail in and out.

When you pull on the paper, the cutting edge comes with it; when you tear off the paper the knife springs back

## Wrapping-Paper Efficiency

THE butcher, the baker, and the candlestick-maker use wrapping-paper roll racks. Without doubt you have seen one in operation, and you may have noticed that every time the storekeeper tears off a piece he must lift the cutting knife in order to grasp the edge of the paper before he pulls.

There has recently been invented an attachment for the roll rack that eliminates this. The loose end of the paper roll fits between two pieces of curved metal attached to the shaft that holds the roll. The upper one is stationary and the lower one is actuated by a spring. When you pull on the paper the lower one—carrying the cutting knife—comes with it. You tear off the sheet and the lower one with the cutting edge springs back to its original position, leaving behind it the projecting edge of paper, ready for the next pull.

## Silence Reigns Beneath the Bolts

TO shut out noise, put your fingers to your ears—that is the age-old rule. But suppose you wish to use your fingers—to write with, for instance—what then? Mr. Gabino Jauregui, of Argentina, has just patented an ear-closing device that covers this case and others similar. It looks like one of those braces that children with weak backs sometimes have to wear and is undoubtedly just as uncomfortable.

Mr. Jauregui treats the hole in your ear as if it were a hole in wood and screws a bolt into it. The ear-bolts are held by a bracket that curves up over your head and is kept in place by a two-legged stand, the legs of which rest on top of your head.

To use this contrivance, when you hear a noise approaching you quickly adjust the screws and bolts and get into your head-gear—that is, if you prefer it to noise.

Ears he has, but he hears not the disturbing noises without because of his head-gear

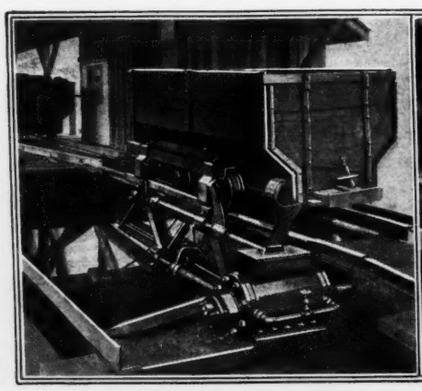
## They Deliver Their Loads and Pass On

BEHOLD the self-dumping dump-car. Credit for this should be given, not to the dump-car, but to the mechanical device that makes it possible. A train of cars comes down the track until it is within a few feet of the dumping device, whereupon a brake stops it.

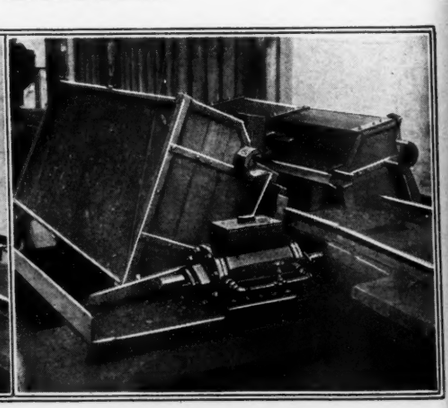
A weighman, who is the sole attendant of the train, then uncouples the cars and releases the brake. The cars slide forward and are weighed—one by one. The first one continues to slide until it passes on to the rails of the dumping device. The rails are depressed by the weight of the car, and this depression automatically relocks the brakes, so that the remainder of the cars are firmly held back.

The car is clutched by the dumping device and is automatically turned over. But, as it goes over, another set of tracks come up and the second car slides on to them—the revolving action releasing its brakes.

As the empty cars rise up they shoot down the track, making way for the loaded ones.



Just before the car turns over: the remaining cars are seen in the background, waiting for the brake to release them



As the loaded car turns over, an empty one comes up and slides down the tracks out of the way of a second car

# Did Your Automobile Freeze Up Last Night?

## Common sense will prevent cracked cylinders

By Ronald L. Prindle

TO start an automobile engine in zero weather is a problem the exact difficulty of which depends upon the construction and size of the engine, the quality of fuel used, the strength of the spark, and, of course, the height of the mercury in the thermometer at that particular time.

As a first aid in starting, priming is probably the best way out of the predicament. There are as many ways of priming an engine as there are of wooing a woman. The chief idea of priming is to get a rich, explosive mixture that will fire the instant it touches the spark-gaps. After the engine has been coaxed into starting it will (if so inclined) get up enough speed to run upon its customary allowance of gasoline. To make doubly sure, it is advisable to pull out the primer a short distance to make the usual mixture slightly richer than normal, until the engine obtains sufficient heat for average carburetion.

### *Don't Hurry Your Engine*

Take time to warm up the engine. Remember that nothing is gained by trying to hurry it. If the car has been standing twenty-four hours the oil has drained back from the cylinder walls and bearing surfaces, and the crankcase oil, if cold, is sluggish and viscous. Naturally, it will take a little time to get back to its normal operating condition, and this will occur only when the engine is thoroughly warm. Run the engine slowly for three or four minutes and you will economize not only in repair bills but also in oil and gasoline.

When you start your car these cold mornings, have you noticed that before the engine starts the self-starter whirs a longer time than it did in summer? The self-starter is designed to start the engine, and will if the battery is in proper condition. But the current consumption is not by any means proportionate to the time the self-starter consumes in starting the engine.

The greater viscosity of cold oil in winter will make the starting torque so great as to demand three or four times the amount of current from the battery that it did in summer. Therefore, assist the starting motor by providing the rich mixture mentioned. In doing this you remove a goodly portion of the burden that would otherwise be demanded from the battery.

### *Time for Anti-Skid Chains*

The driver who fails to equip his car with some form of anti-skid chains for winter is neglecting a sane precaution. Chains, however, should be used only when absolutely necessary, and they should be fitted loosely enough to work around the tire and distribute the strain; yet they should not be so loose as to form a "bundle" and produce bumping, which is very detrimental to the tread. Your tire man will tell you that chains are a form of insurance against accident. You pay for them in the shortened life of your tires, but the wear due to chains is very slight and the insurance is well worth while.

However, chains applied too tightly will shorten the life of the tires considerably. Moreover, they will not prevent skidding if applied in this manner and will bite into the tread, playing the part of a skate. This is especially true on wet or icy pavements and the bite in the tread can easily be recognized and the cause determined on account of the chain-link impression on the tread that is usually in evidence.

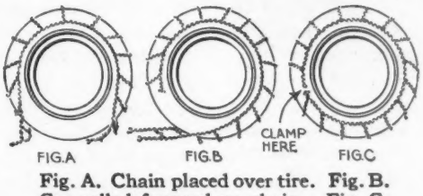
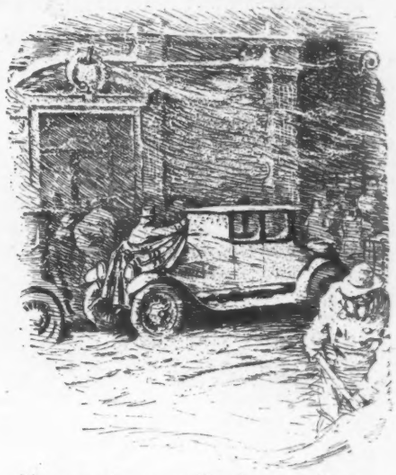



Fig. A. Chain placed over tire. Fig. B. Car rolled forward on chain. Fig. C. Chain buckled together without difficulty. Apply your chains this way hereafter. You will save time and trouble

Chains should never be applied when the carcass of the tire is exposed. Disregard this point and it will prove costly. Furthermore, the blowout takes place at a most inconvenient time, because chains are usually attached on rainy days, on muddy roads, or in the winter after a snowfall.

Don't trust to your chains to prevent skidding on pavements. A skid usually results from the lack of a secure grip of the tires upon the pavement. It sometimes happens on a dry roadway, but usually this is due to excessive speed. Some drivers find that their car skids nearly every time they put on the brakes, especially on a wet pavement. This is probably due to the brakes not being adjusted to the same tension, so that one brake takes hold sooner than the other, a condition which naturally wears off one tread sooner than the other, and causes the car to swing around because of the one-sided resistance. If this happens even when the brakes do take hold equally, it may be that the driver applies the brakes too suddenly, or the brakes may lock. In either case the result is the same: the wheels lock and slide along on one place in the tire and the resistance to forward motion is the same as that to side motion, so that it is just as easy for the car to slide sideways as forward.



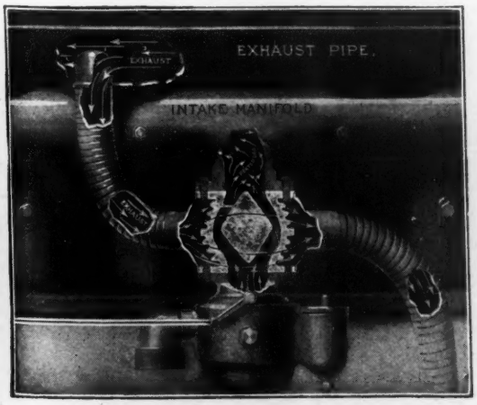
You promise yourself to buy a radiator cover for your car. The robe is a poor makeshift in zero weather, and the car may freeze in spite of it

### *Cold Weather Breaks Glass*

Watch your windshield these cold mornings. The cold makes the glass more brittle, and often a sharp jerk on the windshield to change its position will crack the glass.

When you come in from a long drive and the car-top is covered with snow, brush the top by folding it back, and then put it up again to dry. A folded top, if damp, will deteriorate rapidly and will soon discolor and crack. Never clean a top with gasoline, for gasoline will ruin any rubber which is in the fabric or construction. When the top needs cleaning, use good castile soap and a scrubbing-brush. Soap and water will have an equally good effect on the celluloid windows.

Watch your radiator for leaks especially at this time of the year. It will naturally be filled with anti-freezing liquid in winter, and, while a small leak in the summer would not be serious, the present high price of non-freeze fluids should lead car-owners to make a careful inspection frequently.




This device utilizes the hot air in the exhaust to heat the gas mixture on its way to the engine

# Gear Changing as a Fine Art for the Motorist

## A little study of your automobile will help you to make a smooth getaway

MR. MOTORIST, have you ever envied the automobile driver who pulls away from the curb with never a clash of the car's gears? Who knows exactly when to shift the gear lever and who does it so quietly that it seems to you, sitting beside him, that his car hasn't any gears at all. Of course you have; but why envy him when you can do the same with your own car if you will only find out what happens in the transmission under the floor-boards.

The design of the transmission and clutch has much to do with successful gear shifting, but however perfect the mechanism may be a certain amount of practice is necessary to shift the gears without the ends of the gear teeth striking together. It is this clashing of teeth that makes the grinding noise which makes your repair man welcome you so cordially when you pull up for oil or gasoline. He knows that, as a result, sooner or later you will have to put your car in his workshop—hence his smile. Ignorance of the proper way to shift gears results in the gradual wearing away of the teeth, and, in extreme cases, strips them from the bodies of the gears. In every case a noisy transmission results.

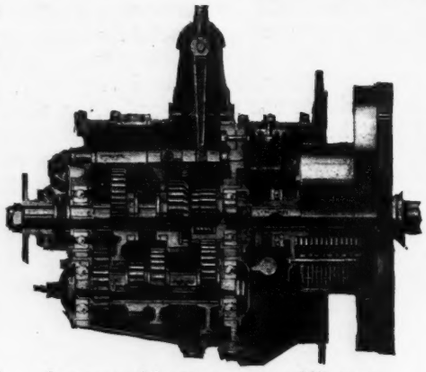
### *Inside the Gear Box*

The transmission is made up of a series of gears, mounted upon a main shaft and a counter shaft, with an idler gear mounted upon the transmission case. The first and second speeds and reverse are three sets of reduction gears with various ratios. High speed is on direct drive, which means that the drive-shaft to the rear wheels revolves at the same speed as the engine crank shaft.

When the clutch-pedal is pushed down (or "out," in automobile parlance) the engine is disconnected from the transmission, which releases the pressure of the gear teeth against each other and allows the gears to be shifted easily. The lower end of the shift lever connects with the gear shifting forks, which are so arranged as to push the gears forward and backward on the square main shaft in order to make the different gear combinations.

Here is the whole secret of successful gear changing. The two gears about to be meshed should be revolving slowly and as nearly as possible at the same rate of speed. If one of the gears is revolving much faster than the other it is impossible to shift them without a clash. It is therefore a mistake to let the car gain too great a speed before shifting into a higher combination.

Now, when the car is under way, pull down the hand throttle and take your foot off the accelerator so that the engine idles slowly, throw out the clutch, pull the lever from first speed, then clear to the left and into second speed. Let the clutch in gently and push down the accelerator until the car attains a speed of eight to ten miles an hour, when the clutch should again be disengaged, the foot removed from the accelerator and the lever pulled straight back into high position. All these motions should be made deliberately and without haste. Usually the driver is in too much of a hurry to make the shifting smooth. Don't grasp the lever tightly in your hand—this does not help the shifting one bit and only makes you tired. By moving the lever backwards with the tips of the fingers the driver can actually feel when the gears are turning at the right speed and mesh them quietly. When the lever is gripped tightly this is impossible.



Ignorance of the proper way to shift gears results in the gradual wearing away of the teeth, and in extreme cases strips them

But in heavy pulling, or on an upgrade, where the car will slow down the instant the accelerator is released, the gear shifting must be made quickly and firmly in all speeds.

Shifting from high to second or low speed is just the reverse of these motions, except in the handling of the accelerator. The principle of the thing is to make the shift as quickly and firmly as possible so as not to let the gears slow down. The clutch pedal must only be pressed down far enough to barely release the clutch.

### *Don't be Impatient*

Never attempt to put the shift lever in reverse nor shift from reverse to a forward speed until the car is at a standstill. If you do an enormous strain is thrown upon the entire mechanism.

In starting the car on a steep hill, hold down the brake with the right foot, put the shift lever in first speed and use the hand throttle to get away, releasing the brake slowly as the engine takes up the load; and when starting down a grade put the lever in first or high speed and let the momentum of the car start the engine. This economizes upon the battery and does not injure the car.

If you follow the above rules and conscientiously study the peculiarities of your own particular car (for every car has its own likes and dislikes exactly as would a horse) you will soon become an expert driver and operate your car automatically and with precision. Try it and see.

Here is a phantom view of a popular make of automobile. Illustrations like this do much to educate the motorist in the mysteries inside of an engine. A little study will make it apparent that even the twin six can easily be kept in condition by an amateur

# A Christmas present any real boy is proud to get

CHRISTMAS and a Winchester! What a combination for a real American boy!

Will this Christmas bring YOU a Winchester? That's up to Dad.

Dad knows you want to shoot and he knows you ought to shoot. He'll get you your Winchester for Christmas if you tell him that's what you want.

## How to get your Winchester

You want the Winchester — Dad will get it for you — and the dealer has it. Ask Dad to take you to the dealer's store.

Get the dealer to show you the W. J. R. C. Range Kit. It's the outfit all riflemen are using now — especially boys who are competing for the famous Winchester marksmanship medals. A shiny, brand-new Winchester .22 rifle, a canvas cover, a natty army cartridge belt, ammunition, cleaning rod and cleaning preparations — all packed in a strong, handsome case — that's what the dealer will take from his shelf.

It's the very outfit boys have been waiting years to get — every shooting need provided for — any boy in the country would be proud to have the W. J. R. C. Range Kit as a Christmas present.

## Official outfit of the W. J. R. C.

Better yet, the W. J. R. C. Range Kit is the OFFICIAL outfit of the Winchester Junior Rifle Corps — packed under the direction of W. J. R. C. National Headquarters!

With the W. J. R. C. Range Kit you, too, can now compete for the famous Winchester trophies — the Marksman, Sharpshooter and Expert Rifleman medals.

Lots of the boys you know have joined the Winchester Junior Rifle Corps and won these rewards of skill with the rifle.

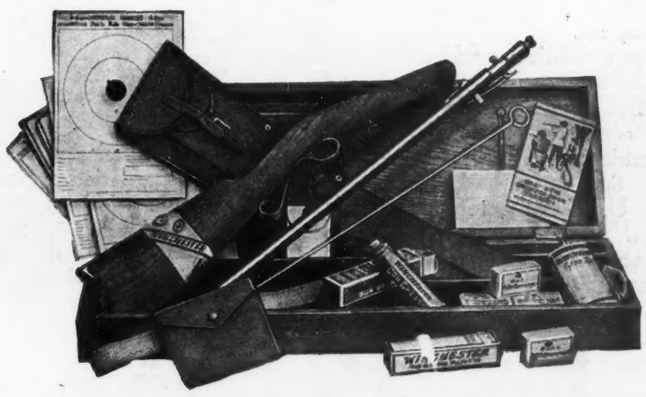
You can do as well. Go to Dad today. Tell him you want the W. J. R. C. Range Kit as you have never wanted anything before.

Get Dad to go to the store with you. When he takes that shiny Winchester out of the Range Kit and fits it to his shoulder, he'll want it just as much as you do.

Speak to him today!

WINCHESTER REPEATING ARMS CO.

Dept. 1220, New Haven Conn. U. S. A.



**WINCHESTER**

*World Standard Guns and Ammunition*

The new W. J. R. C. Range Kit includes everything you need for shooting — a .22 caliber Winchester rifle, a canvas gun case ammunition, cartridge belt, cleaning rod, and three gun cleaning preparations—all packed in a handsome, durable case. The outfit also contains a supply of official targets and a copy of the W. J. R. C. rule book.

# The Electric Ship!

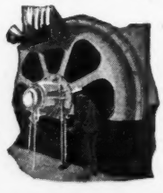
ELECTRIC drive for great ships became a fact with the successful trials of the New Mexico, flagship of the Pacific Fleet, the first battleship to be propelled by electricity.

"This engineering feat," says Secretary Daniels, "holds a peculiar interest to the people of the nation, especially when they realize that in this achievement the American Navy stands, pre-eminent among the nations of the world. It marks an epoch in naval progress." It is another great advance in the mastery of the sea.

Ten years ago electric propulsion for vessels was being discussed by eminent engineers. But it remained for W. L. R. Emmet, consulting engineer of the General Electric Company, in co-operation with the Bureau of Steam Engineering, U. S. Navy, to apply it to large ships.

Five years ago electric drive was installed on the collier Jupiter, while one of her sister ships was equipped with geared steam turbine drive and another with direct-connected reciprocating engines. The results proved the unquestionable superiority of electric drive.

And so electric drive was adopted for the super-dreadnaught New Mexico, with 32,000 tons displacement and a speed of 21 knots. Steam from her oil-burning boilers drives two Curtis turbo-generators, which generate electric current and feed it through a central control to four 7,000 horsepower motors, each coupled to a propeller. Two thousand additional horsepower is generated for lighting, steering, turret machinery, ventilation, winches, windlasses, cranes, radio, telephony, searchlights, laundry, refrigeration, baking, machine shop — making the New Mexico an electric ship indeed!



One of the four G-E 7,000 horsepower electric motors—each on the end of a propeller shaft. They drive the New Mexico up to 21 knots, and can be reversed to full speed astern in thirty seconds.

GENERAL

As a result of the performance of the Jupiter and the New Mexico the United States Navy has adopted electric drive for all its capital ships now under construction or which have been authorized. Its success in the Navy forecasts the rapid adoption of electric drive for merchant ships. In the case of any large ship now operating with reciprocating engines on long voyages, electric propulsion, if substituted, would afford enough improvement to pay for itself in three years.

The operator of this control board—in the center of the ship—controls, through a few levers, the speed and power of the turbo-generators and propelling motors, in immediate response to telegraphic orders from the bridge.

Admiral Benson, until recently Chief of Naval Operations, says, " . . . as soon as the merits of this system become known commercially, electric propulsion will prove its practical value in the Merchant Marine just as thoroughly as it has to the Navy." He states that he regards " . . . electricity as the most economical motive power, from every viewpoint, so far developed for large units."

The chief advantages of electric drive are:

1. Economy — Fuel economy is not only apparent in the operation of electrically propelled ships, but decreased fuel storage room makes way for valuable cargo space.

2. Reliability — Electric propelling machinery has no motion other than simple rotation. Its simplicity in transmitting power from turbine to propeller eliminates the trouble caused by large reciprocating parts or multiplicity of reduction gears.

Two of these 14,000 horsepower Curtis turbo-generators, singly or together, produce current for any or all of the four motors.

3. Flexibility of Installation — Electric motors may be placed in the stern, instead of amidships, greatly reducing the length of propeller shafts and shaft alleys. The turbines can be near the boilers in compact quarters, doing away with many feet of steam piping, and adding valuable space. The power is transmitted the electric way — through small cables. The control can be in any convenient place, even on the bridge.

4. Safety — Electric drive gives vastly greater safety than the old types, because each unit can be isolated in its own water-tight compartment. In collision or other accident the throwing of a switch disconnects a damaged motor or shaft, and in the case of more than one propeller, the power is transmitted to the remaining propellers.

The building of electric propulsion machinery for ships of the Navy and Merchant Marine is but one of the many activities of the General Electric Company in its service to the Government, to transportation, to industries, to science, to cities and to the home.

An illustrated booklet describing the New Mexico, entitled, " The Electric Ship " will be sent upon request. Address General Electric Company, Desk 22, Schenectady, New York.

E L E C T R I C

# What Can Be Done with Horse-Chestnuts

By Frank Hewartson

**Did you know that you could make a unique set of chessmen from horse-chestnuts by simply carving them into interesting shapes when they are soft? Try it and you will be surprised at the peculiar shapes that will emerge from under your knife**

THE majority of us will remember the happy days passed in our childhood fashioning pieces of wood into pigs, small boats, and the like; and at fete times in the winter having hollowed out a large turnip, carved out the eyes, made a hole for the nose and stuck a lighted candle inside. It is evident that the desire to cut and carve is inherent in the instincts of everyone, but how many of us have thought of the possibilities of the common horse-chestnuts? It is to two Frenchmen that credit for the beautiful work accomplished in this direction is due. The many uses to which the humble horse-chestnut may be put are, of course, legion, but the art of carving and dressing the chestnuts with objects of nature requires the genius of a true artist. However, this art is within the reach of the humblest worker, since the materials employed are valueless from a commercial standpoint.

The horse-chestnut has this advantage: when it is fresh the pulp is workable with a knife with the greatest ease, and on drying it becomes as hard as wood and undergoes a retraction that accentuates and exaggerates its natural deformations.

The first thing to be understood by the would-be artist is to know how to utilize the multifarious forms of the chestnut, and to employ its peculiarities, its protuberances, its hollows, and its repressions. It is necessary that the artist have the talent of showing off his work, for it is here that success lies. Then the chestnut, common as it is, rises from the ranks and becomes a thing of beauty.

A clerk in the Paris post-office is responsible for the greater part of the carving. He, unlike many of his comrades, employed his spare time with art instead of at the cafe. By way of amusement he carved chestnuts that he found by the roadside—and distributed them among children of his acquaintance. Naturally they were highly appreciated, and it occasionally happened that their parents dressed the chestnut as a doll.

If the chestnuts are dressed and decorated it is necessary to employ a special method n keeping with nature, which will not make them resemble dolls, nor yet the ordinary marionettes, but which will be original. It will be observed that all the materials employed are to be found either at the seaside or in the country — seeds of various varieties, leaves, and crawfish being all that are necessary.

A very striking figure is that of the "Prudish Old Maiden." The headgear of the figure is formed from the body of a common grasshopper fringed with one of the fine feathers of the peacock. The collarette was taken from the interior of a poppy; the chemisette was cut out of a bamboo leaf; while a chestnut leaf was brought into use for the making of the corsage. The "Major of the British Army" is perhaps the most imposing of all the subjects. He has all the appearance of the austere military man. The busby is fashioned out of the common teasel; the shoulder-straps are made of eucalyptus seeds; while the breastplate is nothing more than a leaf of a chestnut tree. As will be seen, the buttons are perfect, but they are only the seeds of the iris; his medal and decoration are the result of a careful employment of various sizes and colored seeds.

Notice the funny facial contortions shown on the subjects above. As they dry still funnier effects will appear

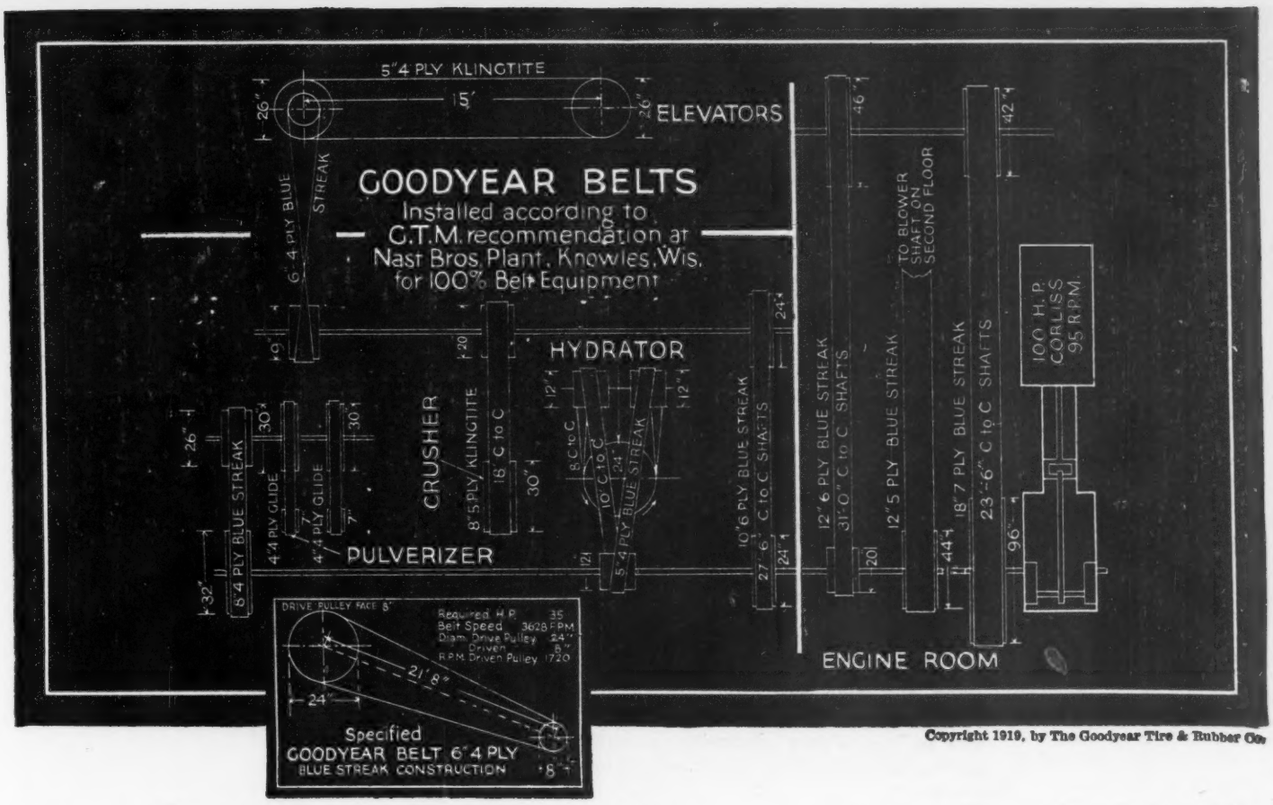
Parts of dead insects, such as wings, etc., will help decorate the figures and give them a rich appearance

The head of a crawfish supplies all of the material necessary for the head and ears of "The Florentine,' while the tail is employed for a visor, the ribs and the breastplate are poppy seeds. A chauffeur's glove does duty for the doublet, while the buttons are used to ornament the shoulder straps. The symbols on the shield are taken from the tail of the crawfish, and pheasant's feathers are employed in the work of ornamenting the casque.

For "The Norman" the tail of a crawfish, of the pink variety this time, is brought into service to supply the headgear. This is surrounded by the crinkled paper one usually sees in the pastry-cook's window, ornamenting those little biscuits commonly known in France as "petits fours." The jewelry is fashioned from various sized prairie seeds. The corsage is fashioned out of a piece of old Japanese embroidery.

In the case of another figure a large coleoptera had to be sacrificed in order to furnish the headdress. The wings have been doubled up, and they form a regular and delicate ornament, while the elytrons, or wing shells, are fashioned into shoulder-straps. The material necessary for the corsage is obtained from a piece of old-gold embroidery. The pendant, which is seen drowned in a knot of lace made of lichens, is made of parsley and a gold beetle of an elongated form, the legs of which have been cut off.

A set of chessmen can be made which will cause visitors to wonder at your originality. Try it and see what funny effects you can produce.




Copyright 1919, by The Goodyear Tire & Rubber Co.

# One Belt, an Entire Plant—and the G. T. M.

***It all began with a belt-killer***—the pulverizer drive. Belts, with good luck, sometimes lasted a year on it. Even then, their short lives were full of trouble; for they stretched, jumped the pulleys, gaped at the plies. Then one day about two years ago, the G. T. M.—Goodyear Technical Man—prescribed a 6-inch, 4-ply Goodyear Blue Streak Belt for service on that gruelling transmission from the 24-inch pulley of the drive shaft to the 8-inch pulley on the pulverizer.

***Today the whole plant*** of Nast Brothers Lime & Stone Co., at Knowles, Wis., is standardized on Goodyear Belts. The initial installation, made in the Company's plant at Marblehead, Wis., on the basis of an expert analysis of actual conditions, has grown from that one Goodyear-served drive to a 100% Goodyear Belt equipment in the plant at Knowles. The study that effected savings in power and time and belt outlay was extended to an entire plant in a succession of analyses.

***Serving different types of drives,*** the belts in the Nast plant today are of varying lengths and widths, different ply and type, but they are all of the one quality—Goodyear. On the hydrator there's a 5-inch, 4-ply Goodyear Blue Streak for heavy duty. An 8-inch, 5-ply Klingtite is in the hard service of the crusher. A pair of 4-inch, 4-ply Goodyear Glides work on the pulverizer. On the long reaches of the engine room shafting, where it's 23 to 31 feet from center to center, 6- and 7-ply Goodyear Blue Streaks unswervingly deliver full load of power.

***Each of them is G. T. M. specified*** to its job. No one type of belt could do more than pretend to meet so many varying requirements. So the G. T. M. recommended application of the particular belt to the particular need. And Mr. Nast, constantly impressed with the 22 months' consistent, day-in, day-out, ten-hours-a-day performance of the original belt, met every G. T. M. recommendation with confidence.

***And in unison the Goodyear Belts*** contribute to the plant operation the highest values of good belting. Flexible, they hold to the pulleys. Unstitched, they wear uniformly. They neither rip nor stretch. Judging, as Superintendent Koeding does, by the staying qualities of the original Goodyear Blue Streak, they will outlast by a year or more the life of the average belt. And their first cost was but little more.

***The same valuable service*** from both the G. T. M. and Goodyear Belting is at your command. The G. T. M.'s analysis of a single drive or a whole plant is free to you. Our reward will come from it by the same process which resulted in the Nast Brothers standardization on 100% Goodyear Belt equipment.

THE GOODYEAR TIRE & RUBBER COMPANY
*Offices Throughout the World*

BELTING • PACKING • HOSE • VALVES

GOODYEAR

MADE IN U.S.A.

# Fares, please!!

The word "fare" has slipped and skidded from its older, warmer, truer meaning.

In stage-coach days, the driver was "host" and the travelers his "fares." Now "fare" has come to mean money.

In fact, for the last 20 years it has become the car rider's equivalent for a nickel.

From a clean seat in a modern electric street car, in its warmth, speed and cleanliness, we may dream back to dustier, colder days, when stout $2.50 shoes nestled on a straw-strewn flooring. Then any ride was uncertain in time. Cars came each hour instead of every five minutes, and puffing steam dummies unerringly shot cinders between father's neck and his inflammable collar.

But this is all gone — all except the tradition that "fare" is unfair when it strays from its old crony, the five-cent piece.

There was a time when a good cigar or a railway track spike could be had two for 10 cents.

Once copper wire and beef steak cost 12 cents a pound; a dollar bought a good hat, a real shirt, a hotel room or a day's work in track labor.

Nothing is left of all this—except the habit of thinking of "fare" as money, instead of in its old meaning—*one who is cared for by a host for pay.*

Let us remember that a penniless host must needs be a poor one.

Let us think about the relation of electric railways and ourselves as mutual—each with definite obligations.

When adjustments are made, let's make them on the basis of a reasonable return for the service rendered — the old true basis of host and fare.

*Published in the interest of Electrical Development by an Institution that will be helped by whatever helps the industry.*

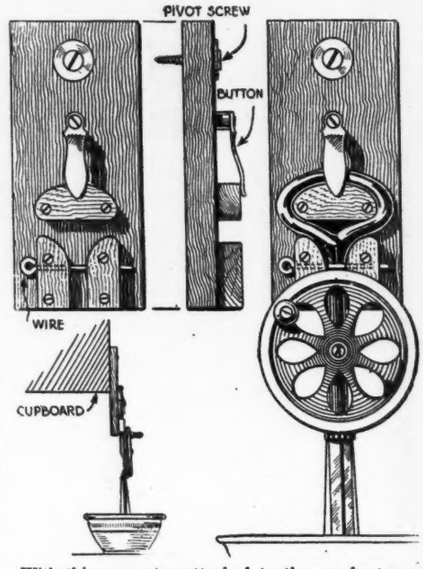
**Western Electric Company**

**No. 1.** *Western Electric — an organization whose products and services apply alike to all fields where electricity is used — in the power plant, in the shop, on the farm and in the home.*

## To Keep the Egg-Beater from Tiring You

THE man who knows how to handle tools can save his wife from tiring her hands and wrists by building an extension handle for the egg-beater. Everyone knows how awkward an article an egg-beater is to operate, and this appliance should be welcome in every kitchen.

Procure a piece of wood about 10 in. long by 3 in. wide. Lay the handle of the beater upon it, and mark the extension handle in the position shown in the illustration. Then cut out three little hardwood blocks, and fasten them in place with screws, so they fit inside and around the handle, holding it snugly. The two bottom ones should be high enough so that a steel pin passed through them will just clear the upper surface of the




With this apparatus attached to the egg-beater it is turned as easily as winding a phonograph

handle and hold it rigid A button over the top piece will serve to hold it in position over that particular block.

Set the beater in place temporarily on the block, and place its bottom in a dish. When in the proper position for beating, screw the block to the cupboard, near the top, by a large pivot screw. Thus the block may be swung up and out of the way against the cupboard when not in use.

With this arrangement the beater is held firmly in position in the dish, and one hand can be used to pour in the ingredients. This is especially valuable in making mayonnaise dressing.— L. B. ROBBINS.

## Overhaul Your Automobile Rims

WINTER is a good time of the year to look over the rims of your car and see that the various parts are not rusted together. Inspect the rims carefully and scrape the rusty parts. Give the rims a coat of aluminum or rim paint which will prevent permanent rust.

# *The Tree with Thirty Thousand Different Kinds of Fruit---*

LONG ago, in the "once upon a time," a South American Indian discovered a sticky substance oozing from a tree. He toyed with it until it congealed in a sticky mass in his hand. He threw it on the ground. It *bounced!* Then he tossed it to a friend.

Thus began the Indian game of "batos," the ancestor of baseball.

Other Indians discovered by accident that when they dropped some of this substance on their arms or legs it hardened. This gave them the idea for making crude moccasins, ornaments and hats.

Such is the mythical story of the beginning of the rubber industry. Today, thanks to experiment and invention, the rubber tree (and there are many different kinds of them) yields some thirty thousand different varities of *fruit.*

In the rubber industry heat control is all important. Everything that is made of rubber must be vulcanized. When rubber is vulcanized it is mixed with sulphur and becomes elastic, or hard, depending upon the amount of sulphur and on temperature control. For without heat sulphur could not be digested by the rubber. Because pressure and temperature play such a vital part in vulcanizing, the use of accurate temperature and pressure indicating, recording and controlling instruments is imperative. Without such instruments there could be no rubber industry, no insulated wire or cables, no automobile tires, no rain-proof clothing, none of some thirty thousand different things.

In great rubber factories, here and abroad, Tycos Temperature Instruments are accepted as the standard of accuracy. It has been the privilege of the Taylor Instrument Companies to have served this industry and hundreds of others for nearly 70 years.

REG'D. TRADE MARK
Tycos
ROCHESTER, N.Y.

*Tycos Wall Thermometers*
To help you maintain a temperature in your house conducive to good health.

*Tycos Bath Thermometers*
To enable you to get the most good from your bath.

*Taylor Home Set*
Bake Oven Thermometer. Candy Thermometer. Sugar Meter. The secret of accurate results in cooking.

*Tycos Hygrometer*
To enable you to keep the humidity of the atmosphere in your home correct at all times.

*Tycos Weather Barometers*
Forecast the weather twenty-four hours ahead with dependable accuracy.

*Taylor Quality Compasses*
To show you the right way in unfamiliar country.

*Tycos Fever Thermometers*
A necessity in every home.

*Tycos Office Thermometers*
An aid in promoting business efficiency.

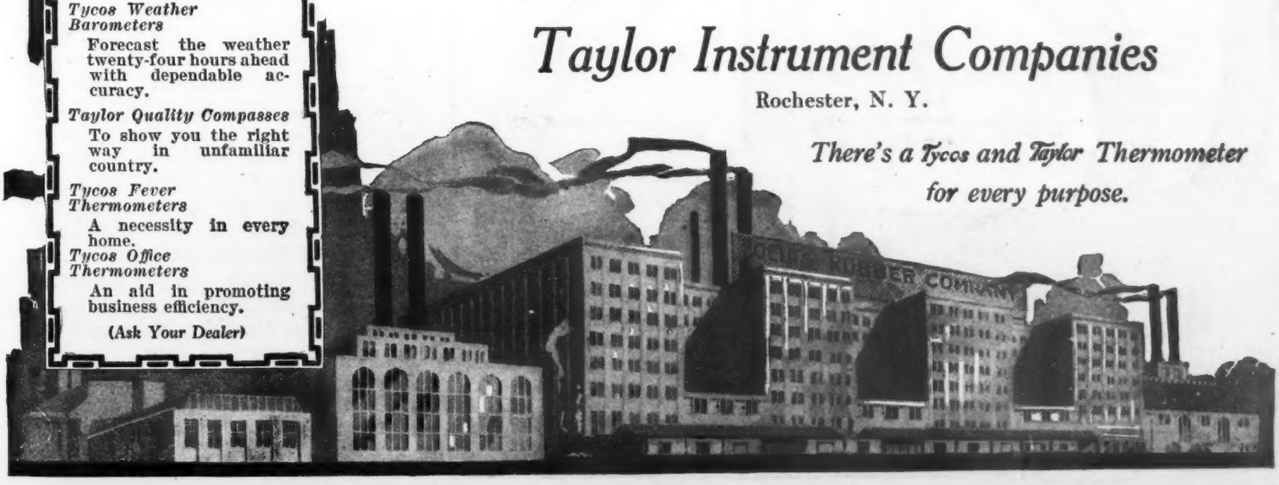
(Ask Your Dealer)

There are over 8,000 different types and styles of instruments in the Tycos line. On the left are listed Tycos instruments for home use. They possess that same dependable accuracy found in all instruments bearing the name "Tycos." Ask your dealer about them. If he won't supply you, write to us direct sending dealer's name. Valuable and instructive literature will be sent you promptly.

## *Taylor Instrument Companies*

Rochester, N. Y.

*There's a Tycos and Taylor Thermometer for every purpose.*



# What a *woven* covering means to portable electric cord

PORTABLE electric cord is only as good as the covering that protects it. What kind do you choose —a thin strand, braided covering—or Duracord?

Duracord is different. It has a covering of thick, heavy strands *woven* like fire hose. It can be battered and pounded and abused and stands up as no other cord will.

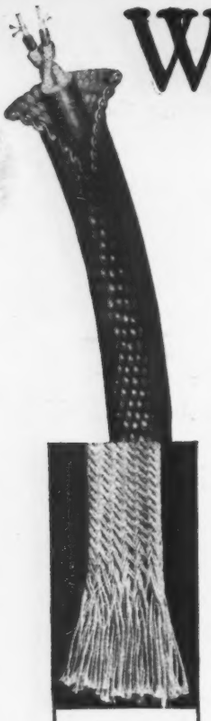
**DURACORD**
TRADE-MARK

In laboratory tests it resisted the pounding of heavy hammers, twenty times longer than ordinary braided cord. It stood fifteen times the abrasion of ordinary cord. In actual use it has proved itself so many times superior to other cords as to be a positive economy.

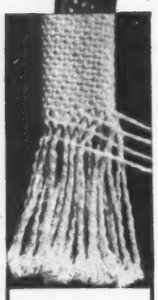
Shipbuilders, manufacturing plants of all kinds, theatres, mines, railroads, etc., are specifying Duracord wherever a portable electric cord is required to withstand hard service.

Duracord will save you money—it will make money for you if you use it in your product. But don't buy it till you see for yourself why it is so good.

Send for samples of Duracord and ordinary cord—test them, compare them in every way. Ask your electrical jobber about Duracord or write us.



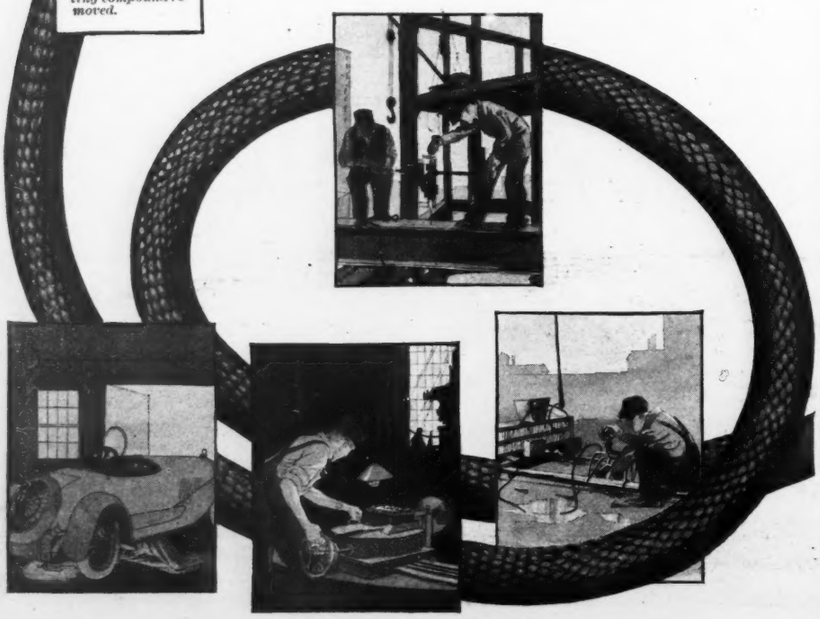
*Here is the ordinary braided cable covering. Note the open and porous construction, easily cut, stretched or unraveled. Compare it with Duracord.*



*This is Duracord. Thick, heavy strands, **woven** like a piece of fire hose, not braided. Picture shows outside covering only with impregnating compound removed.*

**TUBULAR WOVEN FABRIC COMPANY**
**Pawtucket, R. I.**

*Makers of Duraduct the flexible non-metallic conduit, and tubular woven fabrics of all kinds.*




## How to Mend That Broken Umbrella Shank

THE shank of an umbrella was accidentally broken off about 5 in. above the handle, and the owner decided to mend it himself.

He took a block of fairly hard wood, about 5 in. long and 1½ in. in diameter, and with a 3-16 in. wood-drill bored a hole through this block lengthwise. Next, with a ⅝-in. drill (which was a little larger than the broken shank), he bored a hole in one end, the drill following the 3-16-in. hole, keeping it in line to a 3-in. depth.

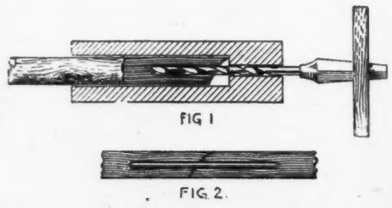


FIG 1

FIG 2.

To mend an umbrella so that the break will not be noticeable

This block (shown in illustration Fig. 1) was to serve as a guide. Wrapping a strip of paper around the shank until the guide would slip over it snugly, he next inserted the 3-16-in. drill in the smaller hole, and carefully drilled a hole about 2 in. deep in the broken end of the shank, using a light pressure at first, to avoid springing the drill out of center.

For this purpose, a cross-piece with a square hole, used as a gimlet-head (as shown), proved easier to work at the required light pressure than a bit-stock.

The mender treated the other half of the break in the same way. He then coated the ends of the break with glue, and inserted a heavy wire nail with the head cut off into the holes, pressed the parts firmly together, and left the whole to set.

When finished, the break was hardly noticeable, and the iron rod in the center made the umbrella stronger than before.—C. A. PEASE.

## Planing Small Pieces of Wood

VERY small pieces of wood are hard to work to exact dimensions with any kind of a plane. It is very difficult to plane the short and narrow edges of such pieces without getting the edges either rounded or out of true, for the reason that the weight and size of the plane, no matter how small, is entirely out of proportion to the size of the piece worked. It is necessary to clamp each piece securely in order to be able to work it at all, which means considerable work and loss of time when all four sides have to be worked.

These difficulties are easily overcome by the very simple expedient of

## A Christmas Corona for the Use and Delight of All the Family

ONE of the country's foremost educators says: "I have urged parents to buy Coronas for their children to use. The youngsters of this generation seem to be poor spellers, and I have made the discovery that the typewriter is the thing to work up interest in and stimulate them to improve their English."

Corona is *the* typewriter of universal utility. It goes wherever it is wanted—into mother's sewing room, father's den, Jack's room. Just close it like a book and take it anywhere. If you go on a trip, slip it into a corner of your luggage or carry it along in its handy case.

Corona retires, when it isn't busy, into a drawer or closet; is instantly ready for service; is so simple that you can learn to use it in two or three times' practising; is astonishingly rugged in construction. It would be hard to select a Christmas gift that the whole family can share with greater pleasure or profit, or that will occupy a more permanent place in the home circle.

*Ask our local representative, or write us for Booklet*

CORONA TYPEWRITER COMPANY, INC.
GROTON, NEW YORK

*Branches and agencies in principal cities all over the world*

**Corona** weighs but a trifle more than six pounds; folds up snugly when not busy; travels where you travel, serves you on the instant. Ruggedly built, simple to operate, always handy, never obtrusive. **$50,** with carrying case.

# CORONA

## *The Personal Writing Machine*

*-fold it up-take it with you-typewrite anywhere*

# Fight Film

## To Save Your Teeth

***All Statements Approved by High Dental Authorities***

### It is Film that Ruins Them

This is why brushed teeth discolor and decay. And why old methods of cleaning have proved so inadequate.

Your teeth are covered with a slimy film. It clings to them, enters crevices and stays. That film is the cause of most tooth troubles.

The tooth brush does not end it. The ordinary dentifrice does not dissolve it. So, month after month, that film remains and may do a ceaseless damage.

That film is what discolors — not the teeth. It is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea. Also of many other troubles.

Dental science, after years of searching, has found a way to combat that film. Able authorities have proved the method by many careful tests. And now, after years of proving, leading dentists all over America are urging its daily use.

### Now Sent for Home Tests

For home use this method is embodied in a dentifrice called Pepsodent. And a 10-Day Tube is sent without charge to anyone who asks.

Pepsodent is based on pepsin, the digestant of albumin. The film is albuminous matter. The object of Pepsodent is to dissolve it, then to day by day combat it.

The way seems simple, but for long pepsin seemed impossible. It must be activated, and the usual agent is an acid harmful to the teeth. But science has discovered a harmless activating method. And millions of teeth are now cleaned daily in this efficient way.

Let a ten-day test show what this new way means. The results are important, both to you and yours. Compare them with results of old-time methods and you will then know what is best.

Cut out the coupon now so you won't forget.

Pepsodent PAT. OFF. REG. U.S.

***The New-Day Dentifrice***

**Now advised by leading dentists everywhere**

### Ten-Day Tube Free

THE PEPSODENT COMPANY,
Dept. 899, 1104 S. Wabash Ave., Chicago, Ill.

Mail 10-Day Tube of Pepsodent to

Name .....

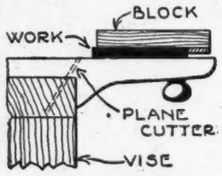
Address .....

### See What It Does

Get this 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the slimy film. See how teeth whiten as the fixed film disappears. Learn what clean teeth mean.


reversing the process of planing, and adopting, after a fashion, the principle of the machine planer, by which, instead of the plane moving over the wood, the wood is dragged over the plane.

All that is necessary is simply to clamp the plane securely in the bench-vise with the cutter facing the operator, and to push the pieces of wood across it. If care is taken to have the cutter very sharp and to have it set rather fine, it will be found that this method gives excellent results. The piece to be worked being always in direct touch with the fingers and also in sight while the plane is solid, quick and easy work is made of truing up the pieces.

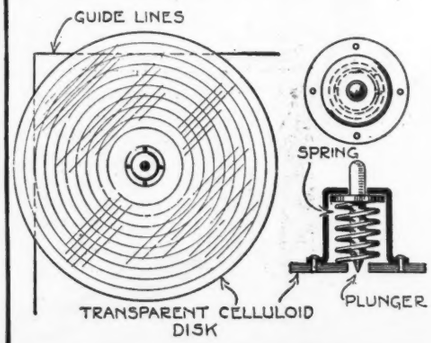



**The piece to be worked upon is always accessible**

If the pieces are so small or so thin as to present an insufficiently secure finger-hold, a push-block or handle can easily be made rom a small block of wood of about the width and length of the pieces to be worked. To the lower edge, near the end, of this block, tack a piece thinner than that to be worked. If the handle is laid on the work, this little block takes hold of the rear end and enables pressure to be exerted in planing.—HENRY SIMON.

### Aiding the Draftsman to Determine Centers

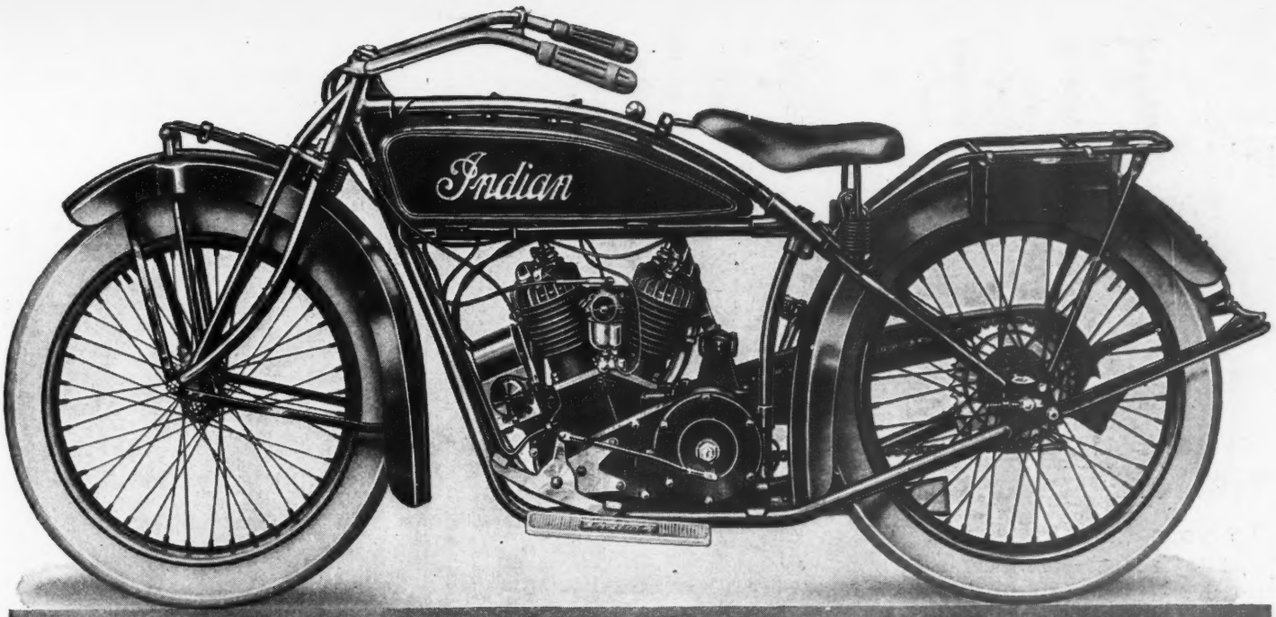
FOR the mechanical draftsman comes this device by which it is easy to find the center of tangent circles. It consists of a circular disk of transparent celluloid about 1-16 in. thick.




**For locating the center of tangent circles the above device will be found invaluable to the draftsman**

A plunger with a needle-point and spring is fitted into a tube riveted to the center of the disk. The illustration shows the device set on a piece of paper with the outer line tangent to the right-angle lines on the paper. By pressing on the plunger a center is made for the point of the compass.

This is easy to make and worth its weight in gold.— WILLIAM FARRELL.




# Indian Scout Model G-20

THE new INDIAN Scout is the latest model to be added to the famous line of INDIAN Motocycles. It is entirely new in conception; new in design and construction; new in many equipment details.

Embodying all the skill and experience of motorcycle building of the past, it is the motorcycle of the future. And, brought within the price range of everybody, it ideally meets the great public's demand for a middle-weight solo mount that posesses the sturdiness and mechanical perfection of its heavier predecessors.

The motor is of the Powerplus type. Side by side valves 2¾ inch bore and 3 1/16 inch stroke. This gives a piston displacement of 36.38 cubic inches. It actually delivers 11½ h. p. Wonderfully quiet, unusually flexible and easily accessible.

The center of gravity is so placed that remarkable ease of control results. And the weight is so correctly distributed, and the saddle position so low, that the balance is perfect. While the reduction in weight makes it 100 pounds lighter than its big brother, the INDIAN Powerplus, nothing has been sacrificed of strength or sturdiness. And no other machine can be operated as economically. 75 miles on a gallon of gasoline, for instance!

Go and see the complete line at your INDIAN dealer's today. Get a practical demonstration of the various models. Choose the machine best suited to your own requirements.

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Watch for the details of mechanical superiorities of INDIAN Scout Model G-20 and Powerplus to be published here each month.

# Indian Motocycle

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To your favorite lake or stream or country resort—hunting, fishing, or just touring—every Sunday is a real vacation when you have a Harley-Davidson.

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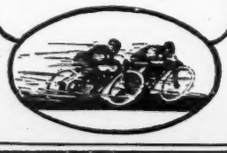
Harley-Davidson won 200-mile World's Championship, Marion, Indiana, September 1st. Finished first, second, third.

Harley-Davidson holds Three-Flag Record (Canada to Mexico) for both Heavy and Medium-Weight machines.

Harley-Davidson holds New York to Chicago record.



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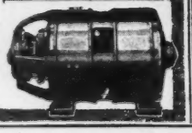

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## Grow Soup Greens in the Winter Kitchen Garden

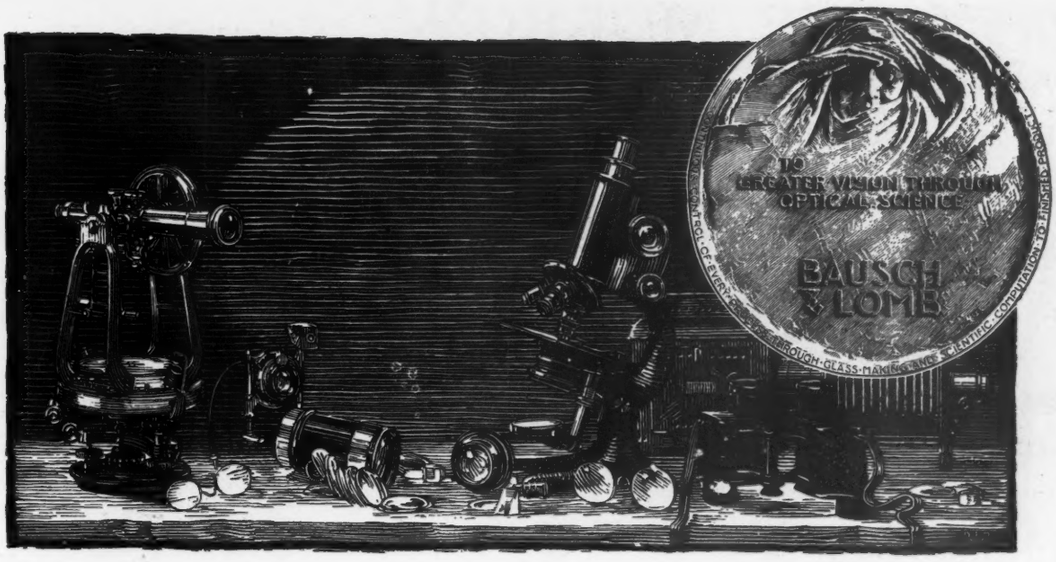
A WINTER kitchen garden supplies the home with all kinds of soup-greens and herbs, and since it is not dependent upon weather conditions the plants will not be killed by the frost.

You can enjoy the looks of the plant and also eat it when you are hungry

The garden consists of a number of flower-pots placed on the sill of the window, and kept from falling by a lath nailed two or three inches above the sill. Each flower-pot must, of course, be placed on a saucer—first, to protect the sill from dirty spots, scratches, and stains caused by moisture, and secondly for irrigating purposes. These pots can be placed in a window-box.

One pot of each of the following herbs will usually be sufficient: thyme,

When snipping the leaves be sure to cut only one at a time, otherwise the others will die too




**A piece of glass ⁂ just a bit of sand and of salt ⁂ exactly combined, carefully melted, skilfully formed and polished—a LENS!** —and windows open upon other worlds, too tiny or too far away for naked eyes to see. Marvelous instruments come to the aid of industry, or play their vital part in war, on land or sea or in the air; old eyes grow young, and weak eyes strong—all through these wonderful bits of glass called lenses, perfected by science that men may see better and farther.

❡ The microscope, revealing all around us the swarming life of organisms too small to measure—

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❡ The unerring camera lens, through which our modern world writes history in pictures—

❡ The projection lens, which translates still or moving pictures from slide or film to screen—

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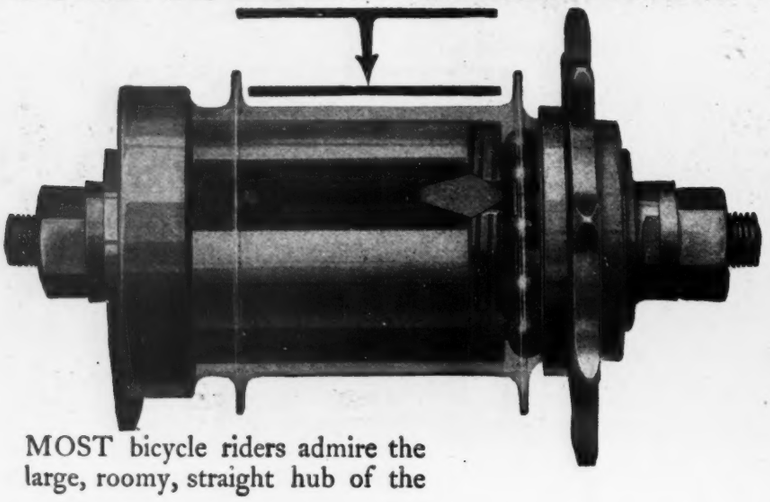
# WHY THE MORROW HAS A STRAIGHT HUB



MOST bicycle riders admire the large, roomy, straight hub of the

**Morrow**
STURDY, SURE
**COASTER BRAKE**

You probably prefer the MORROW because of its pleasing straight and sturdy lines. But you don't buy a coaster brake FOR ITS LOOKS. You buy it for WHAT IT WILL DO. And the STRAIGHT HUB permits the MORROW to do its work better than any other type of hub.

There is more surface *inside* a straight hub, than in a concave hub, and, since the braking power in a MORROW is applied to this extra large *inner* surface of the hub, you have *more braking surface* in a MORROW than in any other coaster brake.

And as the MORROW has even a larger braking surface than in other concave-hub type brakes this means *greater braking power*, giving you *surer* and *more positive* control of your bike.

**7 Reasons for the Morrow**

1. Braking surface 6 3-10 sq. in.—much larger than other brakes.
2. 'Drum' expansion forced equally by two wedges at each end insuring even braking distribution over entire inner hub surface.
3. Bronze brake shoes being softer than hard steel inner surface, grip smoothly firmly, surely.
4. For forward pedaling, the Morrow responds instantly and positively.
5. More ball-bearings than other brakes, so coasts more easily.
6. The Morrow is strong and sturdy; it will stand hard wear.
7. Ninety-five inspections, followed by a final test, guaranteeing perfect service.

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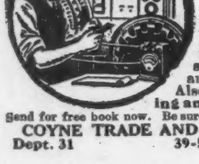

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rosemary, sage, lavender, balm, tarragon and mint. When they are often cut, two pots each of parsley and chives are desirable.

These plants do not require a warm place. Usually a cool, frost-free room,

**Different plants for different soups, all close at hand in the window**

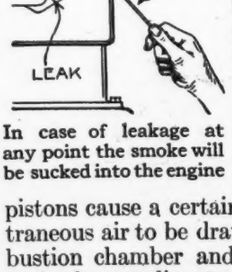
where they will receive plenty of light, is sufficient for their needs. Should some of the plants die off to the roots, the pots should be placed in a warm window where they will soon sprout.

Such annual herbs as summer savory, dill, chervil, basil, etc., should not be forgotten. They can be sown directly in the pot or the seedings can be transplanted.—ERNEST BADE.

## To Test for Intake Leaks in the Automobile Manifold

SOMETIMES the automobile driver is troubled with poor carburetion, and, not knowing the real cause, invariably places the blame on the carburetor, which usually is functioning properly.

In engines which have the intake manifold bolted to the cylinders, a leak in the joints may occur, due either to a defective washer or a loose bolt. Perhaps there may also be a sandhole in the manifold casting. If there is such a leak, the suction strokes of the pistons cause a certain quantity of extraneous air to be drawn into the combustion chamber and become mixed with the gasoline as it is drawn in from the carburetor. This, of course, weakens the mixture. If there is a leak, no matter how minute, it may be located by lighting a piece of punk and bringing its smoke in proximity with the leak.—HUGO ENGEL.



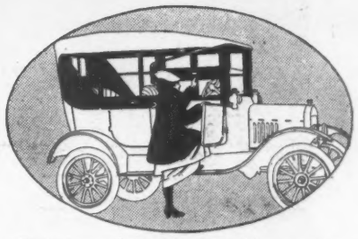

**In case of leakage at any point the smoke will be sucked into the engine**

# How Over 100,000 Ford Owners Obtained Closed Car Comfort

Wherever you go now, you'll find Ford Owners enjoying closed car comfort in the USTUS Limousette.

In Northern Canada where blizzards and icy winter winds make driving in an open car prohibitive, the USTUS Limousette is providing cozy, Limousine luxury.

In balmy Florida and Southern California, Ford Owners shut out the dust and rain and arrive at their destination as fresh and clean as when they left home.



***Features of the USTUS Limousette for Fords***

Provides closed car comfort in bad weather. Is combined with standard Ford body and top without alterations.
Eliminates inconveniences of awkward side curtains
Instantly converted into open or closed car. Gives clear vision from front or sides.

## *Small Cost—Easily Operated*

Is it any wonder that over 100,000 Ford Owners praise the USTUS Limousette? And when Ford Owners consider its small cost in the face of soaring prices today, they are thoroughly convinced of the desirability of owning this practical utility.

Another desirable feature of the USTUS Limousette is the ease with which it can be converted into a closed or open car.

Just a light touch operates the roller windows. It is not necessary for the Driver to leave his seat from behind the wheel to convert his open Ford car into a storm-proof limousine.

## *Used With Standard Cord Top*

The USTUS Limousette weighs only 40 pounds—insures clear vision, front and sides, and a Ford can be equipped with it in an hour. Also it is used in connection with Ford body and top without alterations. It will pay you to know more about the USTUS Limousette for Fords. The USTUS Dealer in your town will be glad to demonstrate its advantages.

Better see him promptly or write to your nearest Distributor for further information.

Orders must be placed now to assure an early delivery. We cannot build Limousettes fast enough to meet the tremendous demand of Ford Owners.

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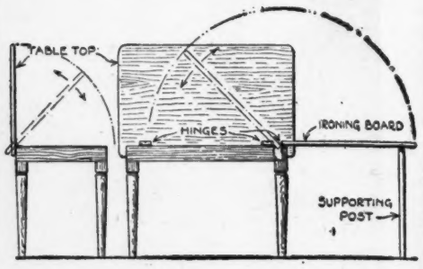
## Conceal the Ironing-Board in a Table

VERY little ingenuity is necessary to make a combination ironing-board and table from an ordinary kitchen table.

After securing four small hinges, remove the top of the table and screw




**When through ironing, lift the table-cover and fold the ironing-board underneath it**

the hinges in place, as shown in the illustration. This will allow the top of the table to swing back.

Cut the ironing-board the proper length to fit inside the table, and set the second pair of hinges in place. A hinged stand can be fastened to the board so that it will rest on the floor and support the board when in position for ironing.

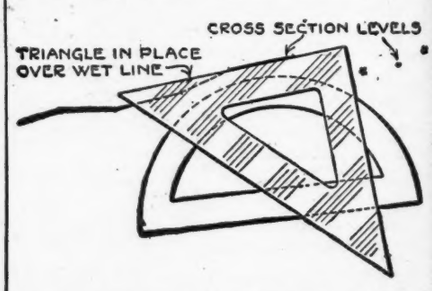
Lengths of wood are cleverly placed in a manner to conceal the ironing-board when it rests beneath the table-top.

Of course the table acts as part of the ironing-board, and the attachment must be so constructed that it will present an even surface when the iron is passed over it.— J. W. MOORE.

## To Prevent Inked Lines from Blotting

HERE is a wrinkle that will prove a great time-saver to draftsmen who have to connect up a number of points with short lines, such as in drawing a highway cross-section.

It is usually necessary to allow one line to dry before another is drawn, in




**No more blotting inked lines if you follow this idea in working on a plan**

order to avoid smearing the wet lines of the drawing.

If a protractor is placed under the triangle, the latter may be adjusted over the lines just drawn without touching them.—PAUL FEATHERSTON.

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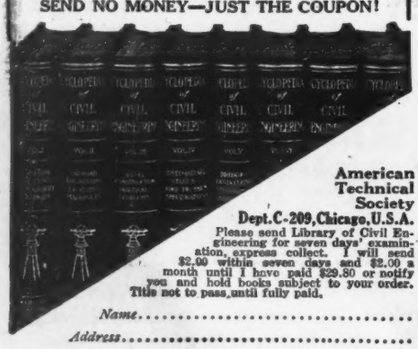

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325 Locust St. St. Louis

# To Owners of AC-Equipped Cars

Is your engine running as smoothly or as powerfully as you have the right to expect?

If not, ask yourself whether you have played fair with the manufacturer of the car you drive.

Do you always insist that your dealer give you AC Spark Plugs when you ask for them,—or do you permit him to sell you something "just as good"?

The manufacturer of your car chose AC Spark Plugs as standard equipment because he found AC Spark Plugs best suited to the needs of his product.

His choice was the result of exacting tests conducted by his chief engineers—tests in which all other plugs had the opportunity to qualify.

If your car is listed below you will know that its maker has selected AC Spark Plugs as standard equipment.

The manufacturer knows how important the proper spark plug is in the successful functioning of his engine. Profit by his experience; follow his judgment; always demand and get AC Spark Plugs.

No matter what car you drive you can secure an AC Spark Plug that has been specially designed for it. For there are various types of AC Spark Plugs designed for every make and style of engine.

Champion Ignition Company
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Austin Manufacturing Co.
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Bates Steel Mule Tractors
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Lalley-Light
Liberty
Locomobile
Maccar Trucks
Maibohm
Marmon
Master Trucks
Maxim Fire Trucks
Maytag
McLaughlin (Canada)
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Meteor
Midland Trucks
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Pierce-Arrow
Pilot
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Ranger Trucks
Red Wing Thorobred Motors
Reo
Re Vere
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Roberts Motors
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Singer
Speedway Motors
Standard "8"
Standard Trucks
Stearns-Knight
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Sterling Engines
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Stewart Trucks
Stoughton Trucks
Straubel Engines
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Universal Trucks
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U. S. Pat. No. 1,135,727, April 13, 1915, U. S. Pat. No. 1.216,139. Feb. 13, 1917, Other Patents Pending

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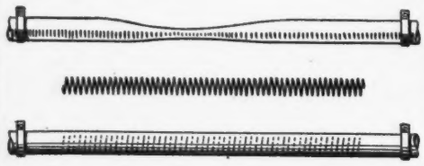
## How to Repair a "Pinched" Radiator Hose

A RADIATOR hose that has collapsed because of excessive heat or other conditions is very simple to repair, provided you know how. Secure a piece of stiff wire, and clamp one end of it together with a piece of shafting in a vise. Twist the wire



Pinched radiator hose can be permanently repaired in this manner. The spring will cause it to inflate again

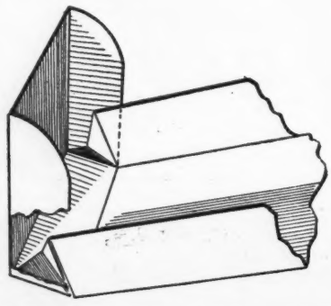
tightly around the shaft, pushing each turn down firmly on the preceding one. In this way make a coil-spring several inches longer than the "pinched" portion of the hose.

Inflate this part of the hose and insert the coil-spring. It will hold the hose in its original shape and there will be no more collapsing. The diameter of the shafting around which the wire is bent should be small enough to allow the outside diameter of the spring to be the inside diameter of the hose. If it fits the hose snugly it will give no trouble. — DAVID BAXTER.

## A One-Piece Paper Box that Has Many Advantages

SUPERIOR to the two-piece cardboard box now in use is this one-piece folding box invented by H. E. Cole for the department-store trade.

On a box of this design measuring 11 by 17½ by 2½ in. there would be a saving of one square foot of cardboard. The forms are stamped from a flat piece of cardboard and the boxes



A new paper box that requires very little storage space; it is made in one piece

made up as needed. The flat stampings naturally require very little storage space.

The glued paper used for sealing boxes can be utilized to great advantage on this kind of box, for it prevents the box from coming apart unless it is completely crushed.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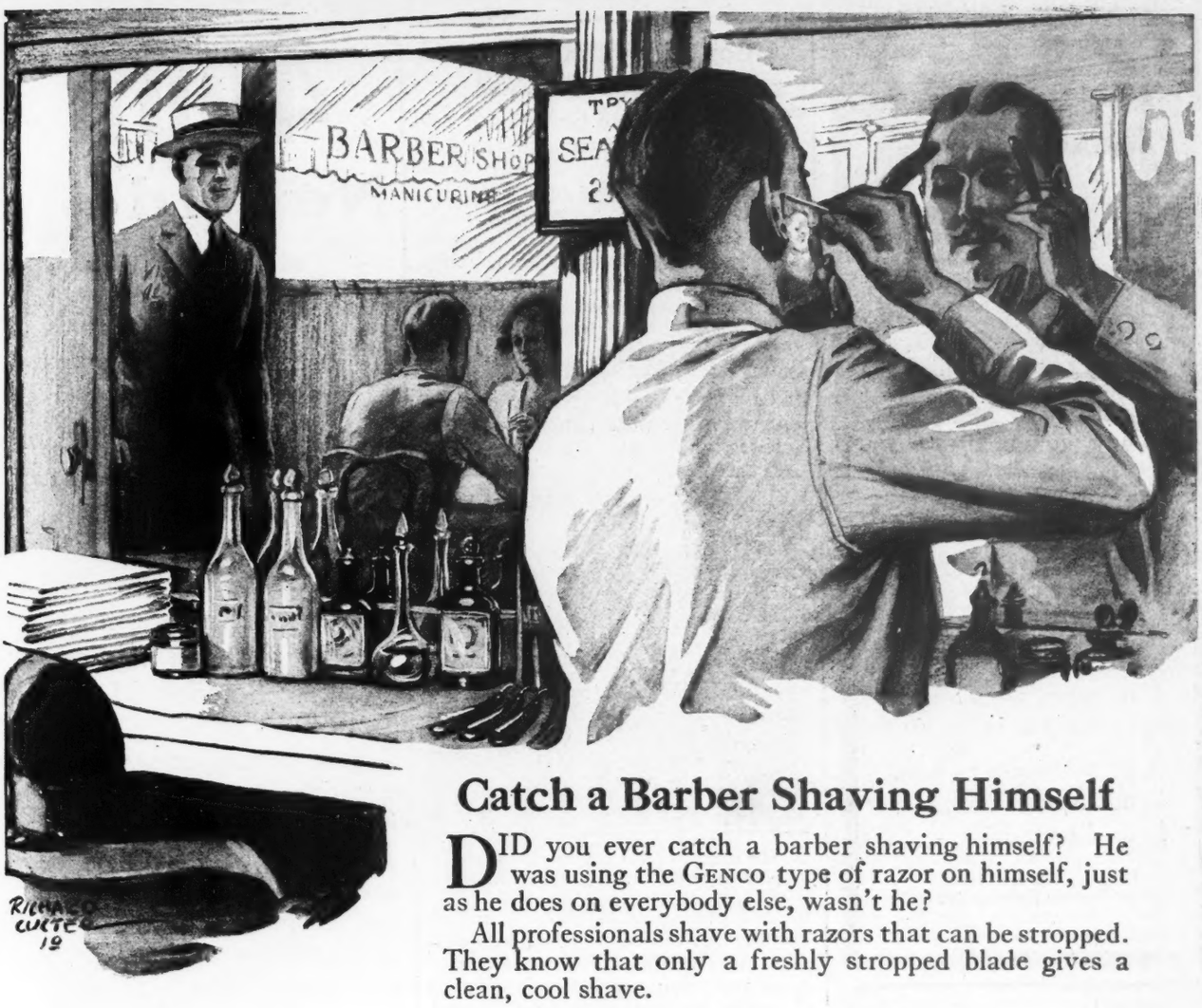


# Catch a Barber Shaving Himself

DID you ever catch a barber shaving himself? He was using the GENCO type of razor on himself, just as he does on everybody else, wasn't he?

All professionals shave with razors that can be stropped. They know that only a freshly stropped blade gives a clean, cool shave.

***Anybody Can Strop a GENCO Razor***

It's designed to strop.

The broad back, concave surface, and slight supporting bulge backing up its edge make it meet the strop at just the correct angle. A few easy strokes and there it is with a truly business-like edge.

Save the time and money in shaving that every barber does. Use the type of razor that every barber uses.

Go to your dealer and look at GENCO Razors. The dealer will show you that anyone can strop them.

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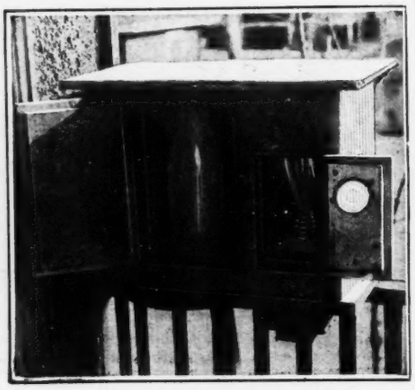
## A Container that Protects Milk from the Cold

IT is provoking to get up on a cold winter morning and find that the milk left by the milkman in the early hours has either frozen solid or is extending an inch beyond the neck of the bottle. This has been overcome by a Chicago man, who has constructed a milk-container that will keep the milk at the proper temperature for the breakfast table.

The device consists of a wooden box divided into two compartments, one to hold the milk and the other containing two sixty-watt lamps to furnish the required heat. The cabinet is



**The electric light contained in the apparatus keeps the milk from freezing**

further lined with asbestos to aid in keeping out the cold. The compartment holding the milk has a series of small grooves in the bottom to permit of better circulation of heat around the bottle. A small glass window in the door of the compartment containing the lamps enables one to see, without opening the door, whether or not the lamps are burning. The whole apparatus works on much the same priniciple as the refrigerator, the difference being the application of heat instead of cold.

When the milkman delivers the milk he simply pushes the button of the switch operating the lamps and goes on his way. When the milk is taken out the current is switched off. The cost of operating the cabinet is almost negligible.—ROBERT H. MOULTON.

## The Way to Tell if Your Car Is Going to Freeze

BEING the "Weather Man" in my city, people often call me up and ask, "Will my car freeze up in my garage tonight?"

Of course I can tell what the outdoor temperature is likely to be; but the difference between that and the temperature of the interior of a garage depends on the construction of the building in question. To determine exactly what such differences would be, I made a series of observations, by means of a minimum thermometer,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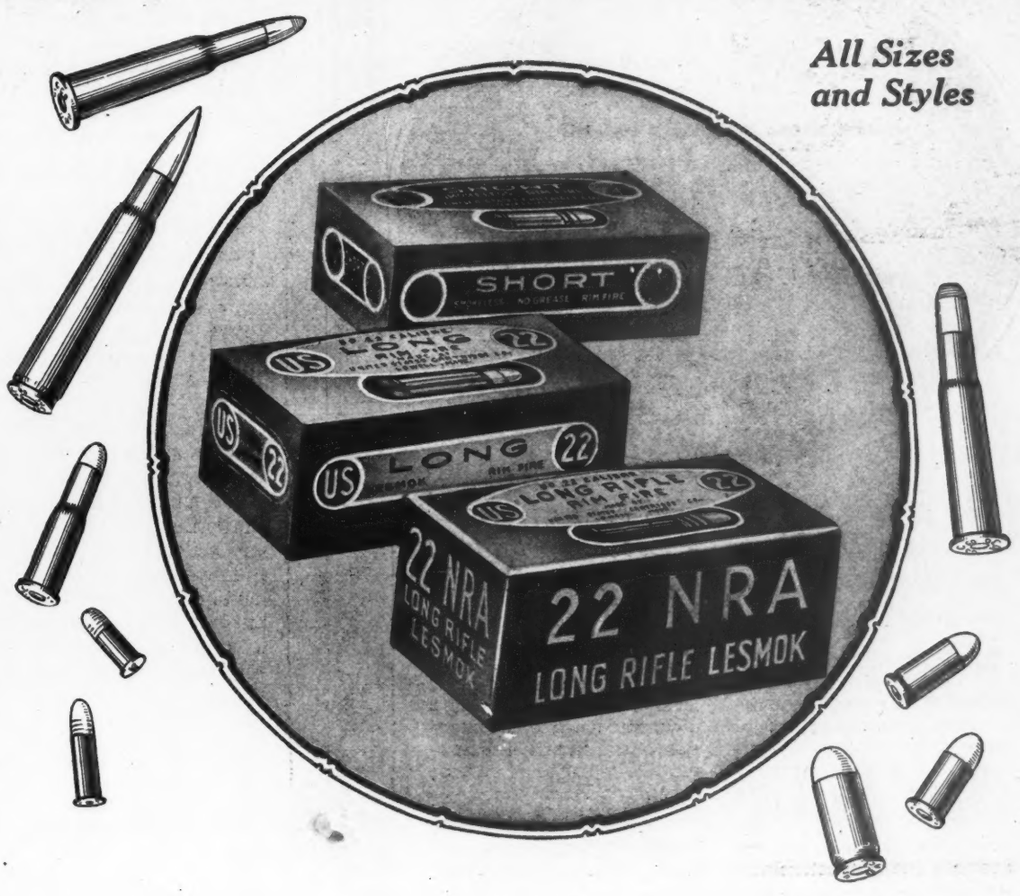


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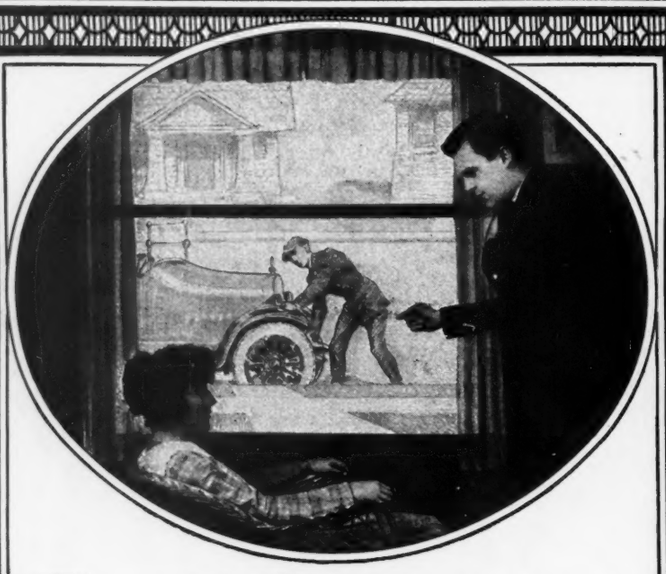

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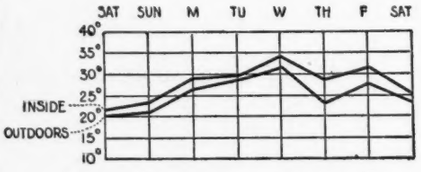
KEEP IT HANDY

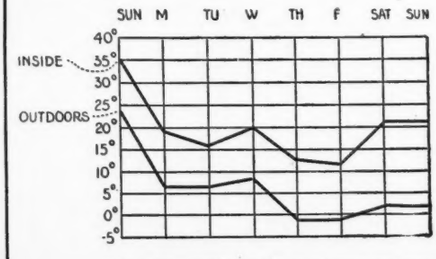

in two garages in my neighborhood. The first observations were taken during a week of rather warm winter weather in a typical frame garage, which was not plastered, but boarded up with shiplap and siding. On the south side of the structure was a large double door, which fitted none too tightly, on the west a small door with




The difference between the outdoor temperature and that of a frame garage does not vary appreciably

glass in its upper half, and on the north a small window.

The other garage was very warmly built, as garages go, being of stucco consisting of three coats of cement, and ceiled all over inside. The large sliding door on the north fitted so loosely that snow sifted in one night; but the door on the east and the small windows on the south and west fitted very well. During the week in which




The temperature in a stucco garage was found to average fourteen degrees warmer than outdoors

observations were taken in this garage the temperatures were very much lower.

In the frame garage the difference varied from half a degree to six degrees warmer inside the garage than outdoors, with an average of two and a half degrees, while in the stucco garage it varied from ten to twenty degrees, or an average of fourteen degrees warmer.—G. A. LOVELAND.

## A Rubber Disk Stopper Will Prevent Evaporation

TO prevent evaporation from moisture entering wide-necked screw-top bottles, such as show-card colors and library paste are sold in, the following remedy is suggested:

Cut a rubber disk out of an old hot-water bottle, rubber shoe, or other piece of scrap rubber, and insert it in place of the cardboard disk that comes in the cover of the container.

By taking this precaution the contents of the bottle will be kept in perfect condition.—A. B. WEGEUER.

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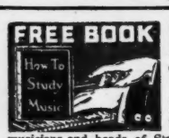


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Names of Candidates, giving their school and their home address, must be mailed to the Scholarship Committee, Popular Science Monthly, 225 West 39th Street, New York City, by the principal or headmaster of the school on or before February 1, 1920.

The Scholarships will be awarded to the candidates passing highest in the examination on the important new scientific inventions and discoveries which have been outlined in the POPULAR SCIENCE MONTHLY'S Service Sheets during the current school year. This examination will be given in the candidates' own school during the last week in May, 1920.

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Nature of the Examination. The examination will be based on the topics in the Teachers' Service Sheets of POPULAR SCIENCE MONTHLY for the months of December, 1919, to and including June, 1920.

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The candidate passing highest in the examination in his group will be declared the winner of the $500 scholarship for that group.

The examination papers will be sent to the Principal of each school in which pupils are to compete. The papers will be sent in a sealed envelope, which must be opened in the presence of the candidates.

The Principal of a school whose pupils are contestants will be required to make a signed declaration that, to the best of his knowledge and belief, the conditions of holding the examination were fully carried out, and that none of the candidates received any aid in answering any of the questions.

The purpose in giving these scholarships is to popularize science in our schools by encouraging the students to apply their class-room work to the practical problems of the outside world.

The POPULAR SCIENCE MONTHLY reserves the right to publish the answers together with the names and photographs of the winners of these Scholarships.

**Scholarship Committee**
**Popular Science Monthly**
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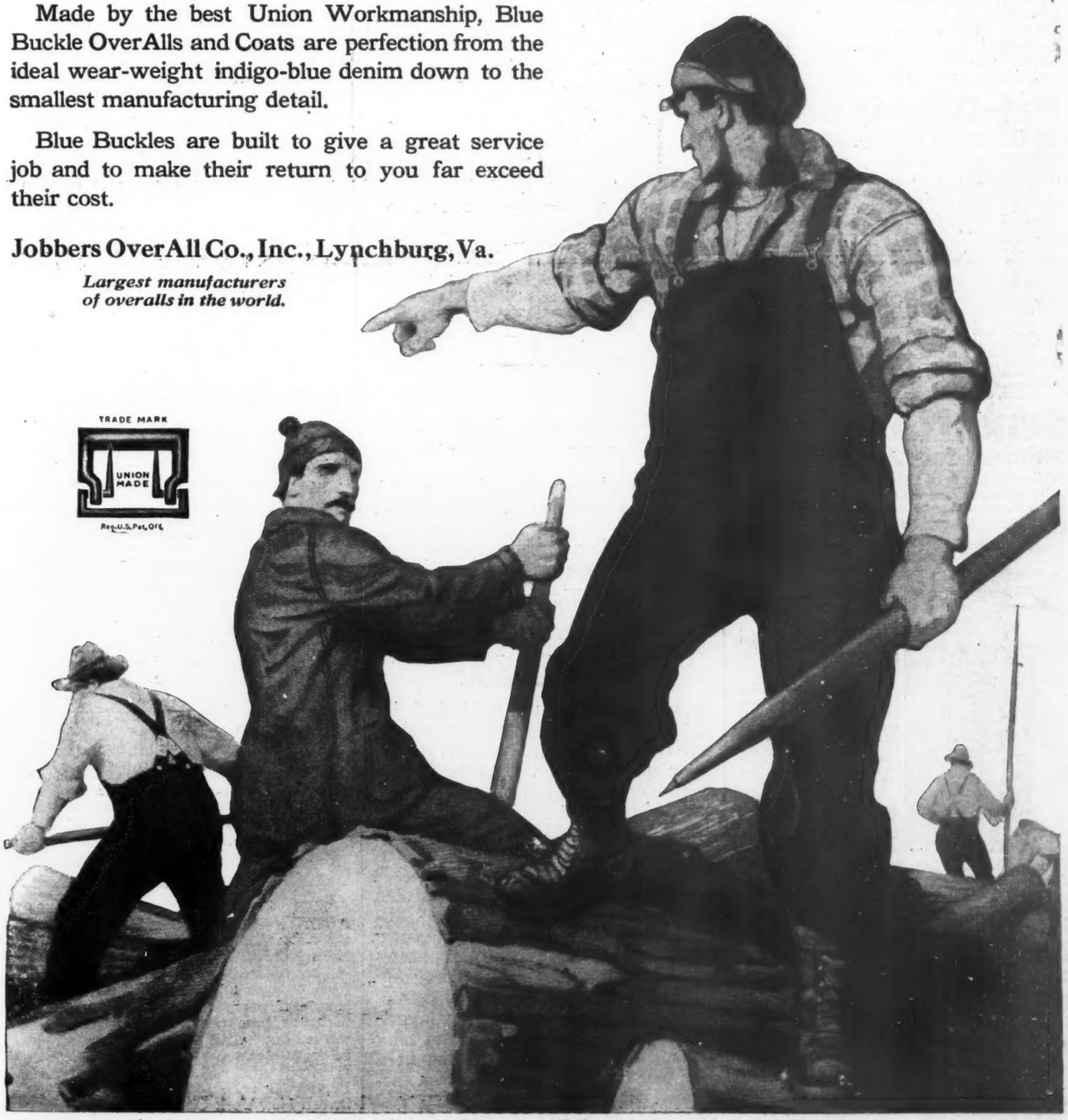

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Write the name of the books you want on the coupon and mail it today. We will send the books at once, express collect, and you can use them just as if they were your own for a whole week. If you decide you don't want to keep them, send them back at our expense.

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If you like the books, as thousands of other men have after examination, just send us $2.00. You can send the balance of the special reduced price the same way—$2.00 each month (50 cents a week). Start right now and learn to fill bigger shoes. There will be a better job looking for you if you do. Be ready to meet it when it comes. *Send the coupon now.*

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**Dept. X- 209 , Chicago**

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Please send me set of .....

.....

for 7 DAYS' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of $ ..... If I decide not to keep the books I will return them at your expense at the end of one week. Title not to pass to me until the set is fully paid for.

Name.....

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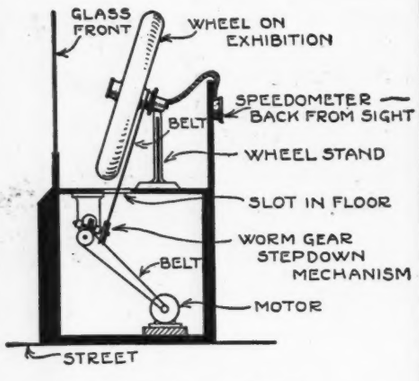
Reference.....


## Show-Window Tire Contest Attracted Customers

A PROGRESSIVE and energetic tire dealer in a Middle Western town made a special effort to attract the attention of the public to his line of goods. On a display stand in his window he rigged up an automobile wheel carrying on its rim the tire he sold. By means of a small motor and borrowed worm-gear step-down mechanism, he was able to reduce the speed of the wheel to about fifty revolutions a minute. A round leather belt ran from the pulley of the worm-gear to the back hub of the wheel, which was dished, then through a slot in the floor to the driving mechanism below.

The wheel was rigged to a speedometer with its face hid from the public. A display card announced that a new tire would be given to the person




This novel tire display for a show window will attract additional customers to your store

who came closest to guessing the reading of the speedometer at the end of the week.

The number of new customers secured more than paid for the expense of the display.— DALE VAN HORN.

## Why Not Make Your Own Solid Alcohol?

FOR household use solid alcohol is fast replacing the liquid article, as it can be handled without danger in an open container. At present there are numerous brands on the market; yet none of these are better than that which can be made in the home at a cost much less than that of the commercial article.

To one pint of denatured alcohol add as much stearic acid as will dissolve in it while the mixture is gently heated. Add a few drops of phenolphthalein solution, mix thoroughly with the melt, and add, drop by drop, enough of a strong sodium hydroxide solution to give the melt a faint pink color. Let it cool and harden in a flat pan, and after the mass has solidified cut into cubes.


# SAVE 1/2

## Your "Gas" and ALL Your Trouble

**Evidence!**—"I showed 32.3 miles on Maxwell demonstration with U. & J. Carburetor—32½ miles per gallon with Ford."

*M. E. Scott, Berry, Ia.*

## U. & J. CARBURETOR

Doubles Mileage — **Guaranteed** to start car in Zero weather—No Priming. Entirely NEW principle—not a moving part—Simple. Has the Pep and Power. 50,000 delighted users. Now ready for Ford, Dodge, Maxwell and Overland.

**15-DAY FREE TRIAL**
**Money-back Guarantee**

DEALERS—Service Stations, Salesmen: The "U. & J." sells on demonstration—installed in thirty minutes—some good open territory.

**U. & J. FORD TIMER will last as long as the car. Price $1.75.**

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## The Police Key

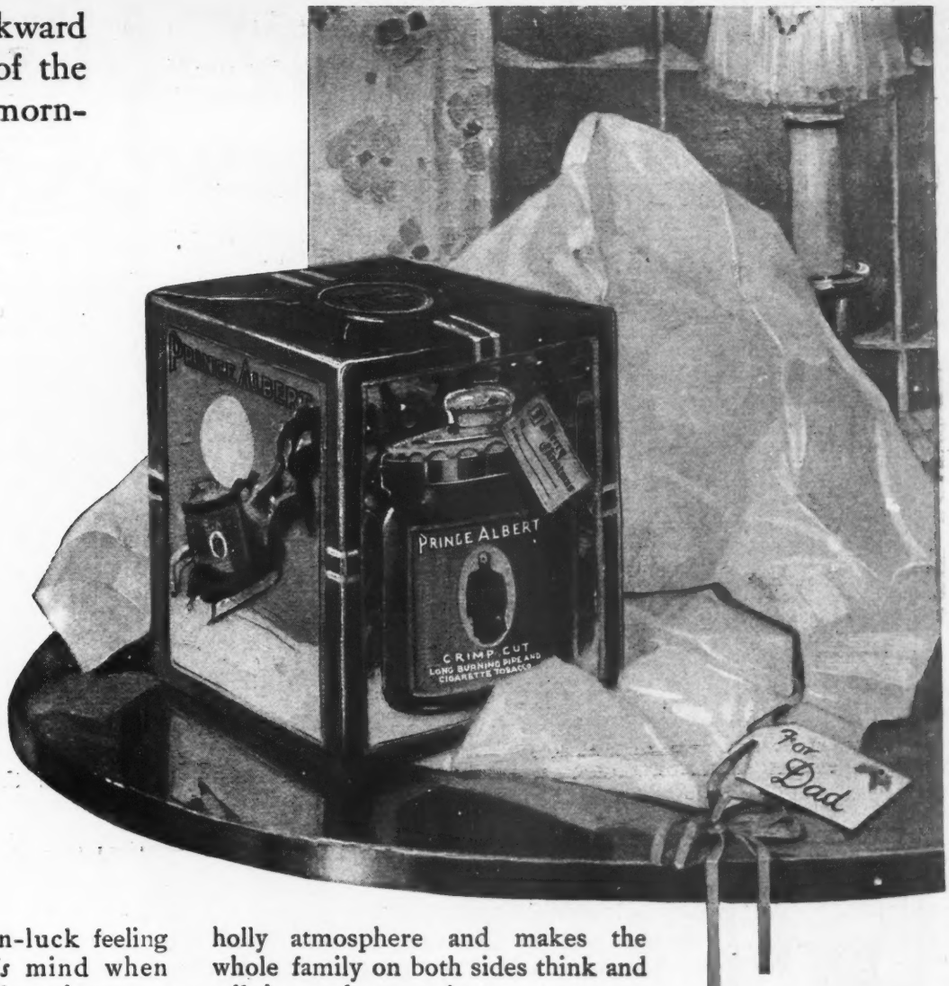
is as serviceable as a whole bunch of ordinary keys; opens almost everything; every house-owner should have one. Sent postpaid on receipt of 20 cents, three for 50 cents. Safety Key Holder free with every key.
**Sharpe Mfg. Co., Paterson, N. J.**

THE CONSTRUCTION OF SMALL ALTERNATING CURRENT MOTORS, By A. E. Watson, Professor of Electricity, Brown University.

This book contains complete instruction for building small alternating current motors in several sizes. The designs are in harmony with the best manufacturers and can be worked out by the amateur for making useful instruments.

Price postpaid $1.00. Book Department, Popular Science Monthly, 225 West 39th Street, New York City.

TAKING awkward angles out of the early Christmas morning atmosphere!




HOW that low-on-luck feeling will peel off *his* mind when the happy-handout-happens Christmas morning; and, his keen eye sights the stage all set with the pound crystal glass humidor of Prince Albert tobacco gowned in the glories of a radiant holiday rainbow! Turkey takes to the tall timbers compared with the all-star-feast *you* spread so temptingly before his smokeappetite!

PRINCE ALBERT, for Christmas, lands on a man's tank-of-thanks like a spill-of-snow when the sleigh-bells are rusty from lack of jingles! P. A. as a *man gift* is the high-sign, the last word, the directest route to his comfort, his contentment, his smoke-happiness! It's the touch-that-lifts-the-lid; that takes the awkward angles out of the evergreen-and-holly atmosphere and makes the whole family on both sides think and talk in one language!

YOU'LL enjoy seeing *him* fuss his old jimmy pipe, all-brimful with Prince Albert! Or, *getting his* "rolling his own!" Never was such a delightful makin's cigarette as P. A. supplies. He can smoke the limit with Prince Albert *for it can't bite his tongue or parch his throat!* Our exclusive patented process fixes that! He'll just want to get thirty-six-smoke-hours out of the legal twenty-four, *that's all!*

JILL his smokecup to overflowing! Prince Albert is the glad-gift, the holiday-hunch that will hum him a smoke te-de, te-dum long, long after Christmas is but a merry memory!

*PRINCE ALBERT is also sold in handsome pound and half pound tin humidors, in tidy red tins and in toppy red bags—wherever you buy tobacco.*

R. J. REYNOLDS TOBACCO COMPANY
Winston-Salem, N. C.

# PRINCE ALBERT

***the national Christmas joy smoke***

Copyright 1919 by R. J. Reynolds Tobacco Co.

"Are you tired again this morning?"

UNRESTFUL slumber—zest for neither breakfast nor work—nothing but a dreary vision of a tired day—of "I don't know what's come over me."

The steady grind and shocks of work and worry have worn out the nerves' reserve. Short of a complete rest, a scientific food-tonic is the one thing urgently needed—and that means Sanatogen.

For, as Sir Gilbert Parker, the statesman-novelist, writes: "Sanatogen is a true food-tonic, feeding the nerves, increasing the energy and giving fresh vigor to the overworked body and mind."

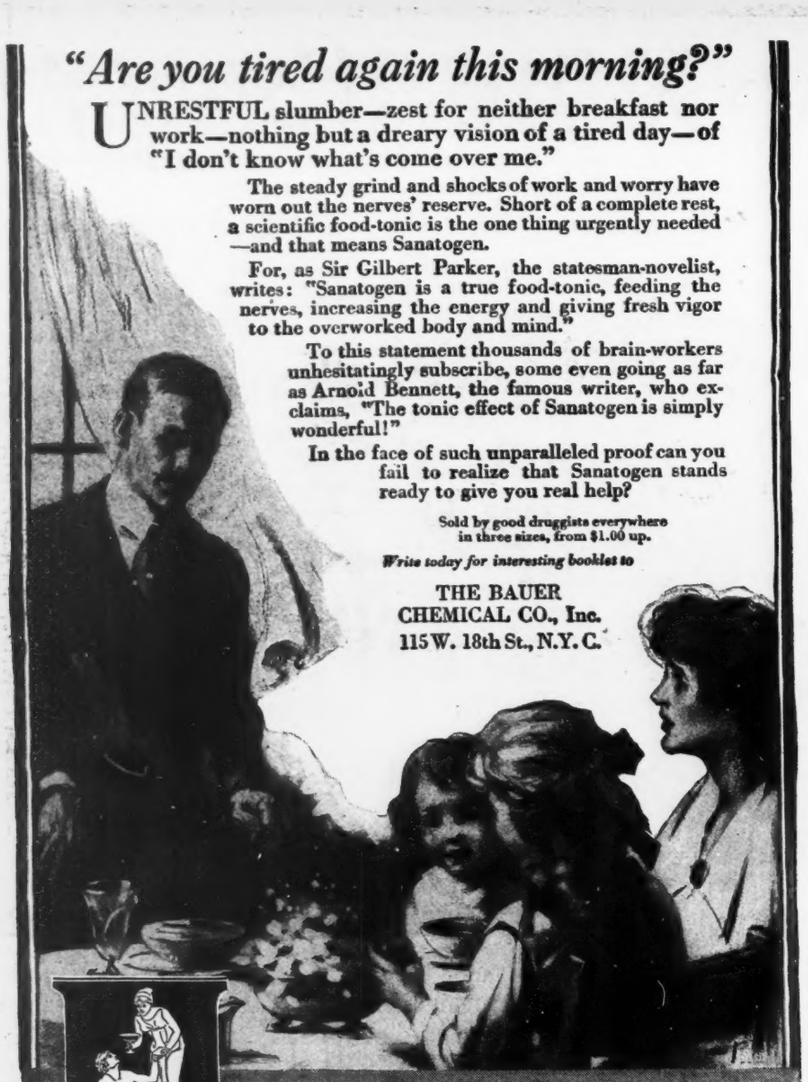
To this statement thousands of brain-workers unhesitatingly subscribe, some even going as far as Arnold Bennett, the famous writer, who exclaims, "The tonic effect of Sanatogen is simply wonderful!"

In the face of such unparalleled proof can you fail to realize that Sanatogen stands ready to give you real help?

Sold by good druggists everywhere in three sizes, from $1.00 up.

*Write today for interesting booklet to*

THE BAUER CHEMICAL CO., Inc.
115 W. 18th St., N.Y.C.



THE FOOD-TONIC APPROVED BY SCIENCE

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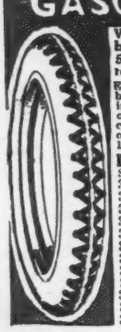

When saving 75 per cent on Tire Cost by Buying Economy Double Tread 5,000 Mile Guaranteed Tires at One-fourth the usual tire cost.

Economy Double Tread Tires made doubly durable by our secret reconstructed process used in manufacturing. They have double the amount of fabric of an ordinary tire, making them practically puncture proof and immune from blowouts. Our customers get from them 5,000 to 10,000 miles of service.

LOOK AT THESE LOW PRICES

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| 30x3 | $ 5.50 | $2.00 |
| 30x3½ | 6.50 | 2.10 |
| 32x3½ S. S. only | 7.50 | 2.20 |
| 31x4 | 8.50 | 2.40 |
| 32x4 | 8.75 | 2.45 |
| 33x4 | 9.00 | 2.50 |
| 34x4 | 9.25 | 2.60 |
| 34x4½ | 10.75 | 2.85 |
| 35x4½ | 11.00 | 2.90 |
| 36x4½ | 11.50 | 3.00 |
| 35x5 | 12.25 | 3.20 |
| 37x5 | 12.75 | 3.35 |

RELINER FREE WITH EVERY TIRE

State whether you want straight side or clincher, plain or non-skid. Send $2 deposit for each tire; $1 on tubes; balance C. O. D., subject to examination, or 5 per cent discount if full amount is sent with order.

ECONOMY TIRE & RUBBER CO.
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Gold and Silver Sign Letters

For store fronts, office windows and glass signs of all kinds. No experience necessary. Anyone can put them on and make money right from the start.

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You can sell to nearby trade or travel all over the country. There is a big demand for window lettering in every town. Send for Free Samples and full particulars.

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9 CORDS IN 10 HOURS

BY ONE MAN. It's KING OF THE WOODS. Saves money and backache. Send for FREE catalog No. B 138 showing low price and latest improvements. First order gets agency.

Folding Sawing Machine Co., 161 West Harrison St., Chicago, Ill.



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Washington, the home of the Pathfinder, has become the World's Capital and reading the Pathfinder will be like sitting in the inner council with those who will mold the world's destiny for the next generation

The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its 27th year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper and we will send the Pathfinder 13 weeks. The 15c does not repay us; we are glad to invest in new friends. Pathfinder, Box 23, Washington, D. C.


## Wind the Anchor Line of the Decoy on a Cleat

THE duck-hunter who has spent weary hours unsnarling the wet, perhaps icy, anchor lines of his decoys at the end of a day of sport will have his labors lightened by the device suggested herein. Instead of the usual sheet of lead tacked to the bottom of the decoy to make it float upright on an even keel, screw on a large galvanized iron cleat, such as can be bought at any hardware store. As each decoy is hauled in, wind the anchor line around the cleat.

The anchor line is simply wound on the decoy

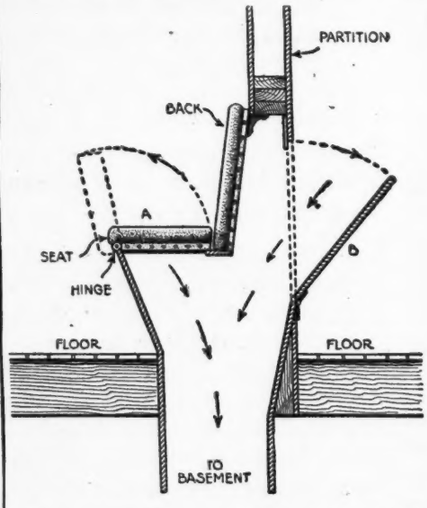
In this way the lines are kept from fouling each other, and no untangling is necessary.—C. L. LOTHROP, JR.

## A Concealed Laundry Chute with Double Openings

HOW many times have you gone to the already overflowing clothes-hamper with your arms full of pieces of linen, and tried to stuff them down into it, finally throwing them down behind the hamper?

To eliminate this annoyance the writer provided a chute, which was ingeniously concealed by a wall seat, and he passes the idea along so that others may benefit by it.

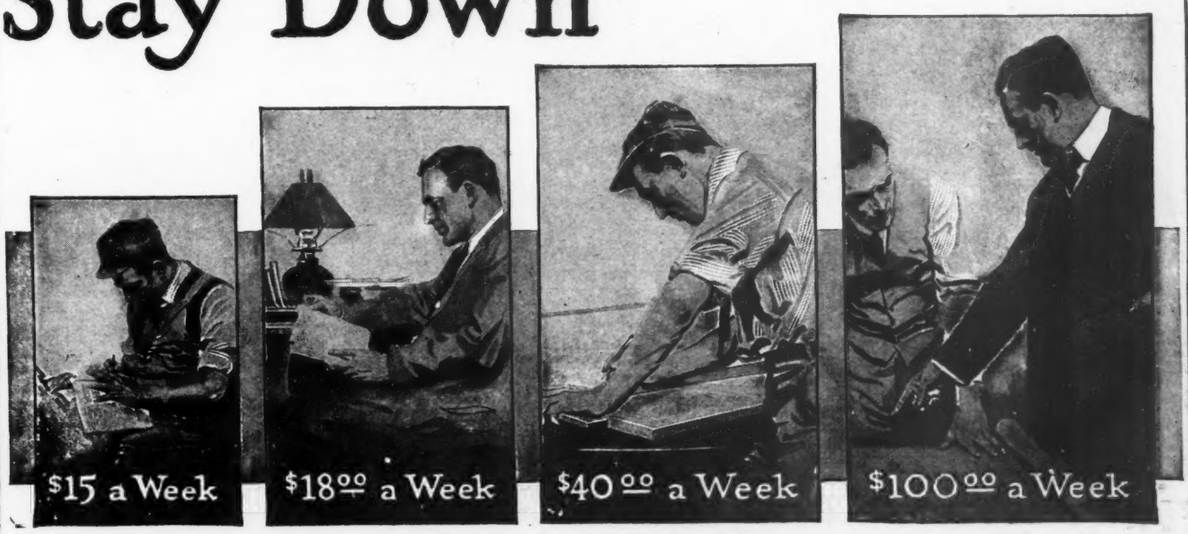
The illustration clearly shows the scheme. *A* represents a neatly upholstered seat made in one bedroom, while *B* represents a door constructed in the adjoining room. This method permits the dropping of clothes to the cellar from either room.




Of course you have seen homes equipped with laundry chutes. Why not make your own?

Of course the chute was merely a tin opening cut through the floor, but it serves its purpose by saving many a long walk.—J. W. MOORE.

# The Man Who *Wouldn't* Stay Down




He was putting in long hours at monotonous unskilled work. His small pay scarcely lasted from one week to the next. Pleasures were few and far between and he couldn't save a cent.

He was down—but he *wouldn't stay there!* He saw other men promoted, and he made up his mind that what they could do *he* could do. Then he found the *reason* they were promoted was because they had special training—an expert knowledge of some one line. So he made up his mind that *he* would get that kind of training.

He marked and mailed to Scranton a coupon like the one below. That was his first step upward. It brought him just the information he was looking for. He found he could get the training he needed right at home in the hours after supper. From that time on he spent part of his spare time studying.

The first reward was not long in coming—an increase in salary. Then came another. Then he was made Foreman. Now he is Superintendent with an income that means independence and all the comforts and pleasures that make life worth living.

It just shows what a man with ambition can do. And this man is only one out of hundreds of thousands who have climbed the same steps to success with the help of the International Correspondence Schools.

## What about *you?*

Are you satisfied merely to hang on where you are or would you, too, like to have a real job and real money? It's entirely up to you. You don't *have* to stay down. You *can* climb to the position you want in the work you like best. Yes, you can! The I. C. S. is ready and anxious to come to you, wherever you are, with the very help you need.

Surely when you have an opportunity that means so much, you can't afford to let another priceless hour pass without at least finding out about it. And the way to do that is easy—without cost, without obligating yourself in any way, mark and mail this coupon.

TEAR OUT HERE

**INTERNATIONAL CORRESPONDENCE SCHOOLS**
**BOX 7659, SCRANTON, PA.**

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Railways
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN OR ENGINEER
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
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- ☐ AGRICULTURE
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- ☐ Spanish
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Name_____
Present Occupation_____
Street and No._____
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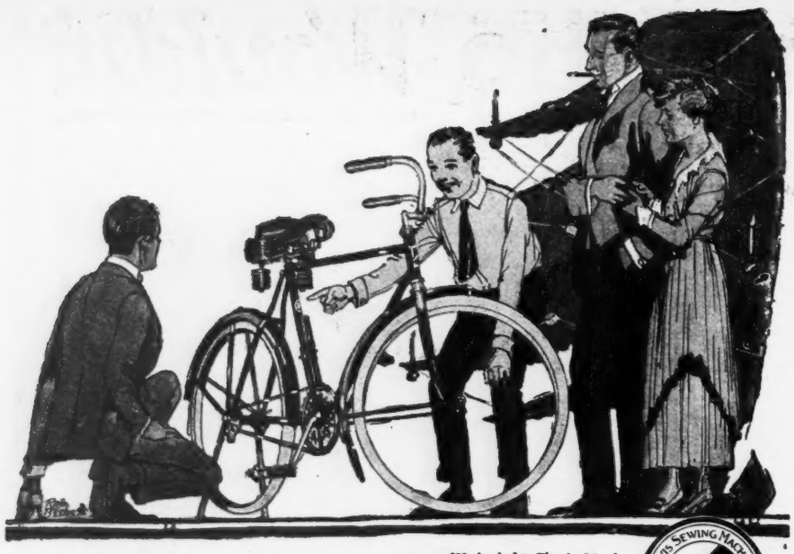
*Canadians may send this coupon to International Correspondence Schools, Montreal, Canada*



*We back this Trade-Mark with our Reputation.*

DAVIS MADE — THE DAVIS SEWING MACHINE CO. DAYTON, OHIO.

# What One Father Learned *Last* Christmas

"Do you know—you fathers and mothers—actually HOW much that boy of yours *wants* a bicycle? Let me tell you.

"I'm a father—and MY boy wanted a bicycle. But like many fathers, I kept putting him off from Christmas to Christmas.

"Finally, LAST Christmas I bought him a bicycle—and I wish you could have seen that youngster Christmas morning.

"There in the middle of the room stood his new *Dayton* bike—bright and shining. And so were his eyes.

"He walked around it—studying its delights from every angle—and finding new ones at every step. And forgetful of everything and everybody—lost in his delight—I heard him saying to himself—over and over:

" 'It's almost too good to be true—too good to be true. And I won't have to borrow rides on Jimmy's bike any more—or get off whenever he tells me to!'

"I thought I knew how much a boy wanted a bicycle—but I NEVER knew until that Christmas morning. And my joy was tempered only by the soul-felt wish that I had REALIZED the tuggings that besiege a boy's heart—and made him THAT happy before."

A *Dayton Bicycle* will make YOUR boy—or anybody—happy THIS Christmas—and YOU, too! See the Dayton dealer in your community—or write for Catalog 44.

Cycle Dept., THE DAVIS SEWING MACHINE CO., Dayton, O.

# Dayton Bicycles



11

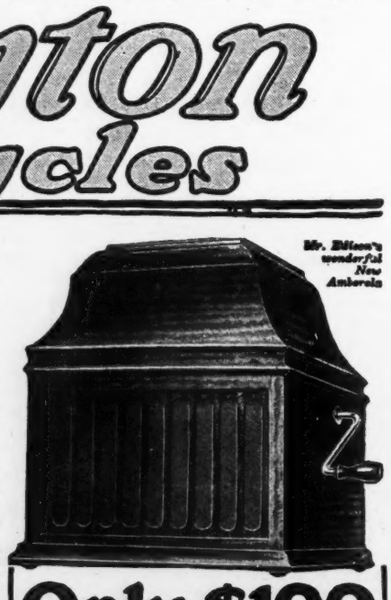
*Here, Bill*
*—a Luden's will fix that throat*

A clear nose and throat will make working easier. Workers in all industries use Luden's the year round. A protection in damp or dust.

LUDEN'S MENTHOL COUGH DROPS
GIVE QUICK RELIEF



*Mr. Edison's wonderful New Amberola*



**Only $1.00 and After Trial**

Keep the New Edison Amberola—Edison's great phonograph with the diamond stylus—and your choice of records, for only $1.00. Pay balance at rate of only a few cents a day. Free trial in your own home, before you decide. Nothing down. Write today, *for our New Edison Book and pictures, free.*

F. K. JARSON, Edison Phonograph Dist. 1369 Edison Blk., Chicago


## The Saw-Tooth Platform Has Advantages

AN idle truck earns no dividends. That is a very clear proposition, thoroughly understood by anybody engaged in transportation. Hence the mad rush to keep the trucks in motion. Any plan for increasing the number of trips is valuable.

Of such a nature is the saw-tooth platform shown in the accompanying

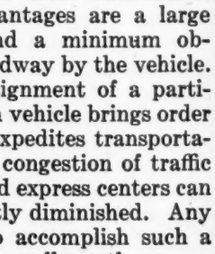
With this type of platform for loading and unloading trucks, traffic congestion is eliminated

illustration. A vehicle can back into one of the saw-tooth sections and load or unload from the side or the rear very quickly. A single article can be removed or adjusted conveniently without unduly disturbing the rest of the load. The form of construction is particularly desirable at depots and warehouses.

Among the advantages are a large platform space and a minimum obstruction of the roadway by the vehicle. Then, too, the assignment of a particular space for each vehicle brings order out of chaos and expedites transportation. In this way congestion of traffic at freight-yards and express centers can be avoided or greatly diminished. Any plan that tends to accomplish such a laudable purpose is well worth a careful consideration.—H. C. RIDGELY.

## Turning a Pipe with an Ordinary Wrench

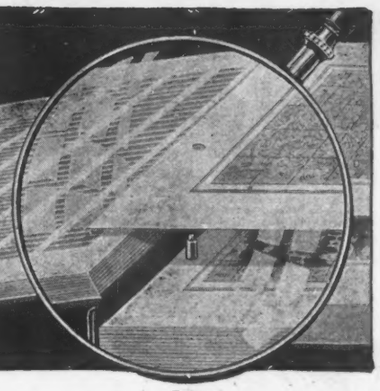
A PLUMBER, on arriving at an important job, found that he had forgotten his stillson wrench and that the work necessitated removing a pipe to get at the seat of the trouble.




The ordinary wrench will turn a pipe with this contrivance

Being an ingenious young man, he immediately hit upon a solution. Asking the house-owner for a bolt, he sawed it lengthwise and inserted the halves between the jaws of his monkey-wrench. He then clamped this contrivance to the pipe and easily unscrewed it.—WILLIAM P. LANGREICH.

# A New Kind of Atlas



## Loose Leaf—Always Up to Date

OUR former atlases have gone hopelessly out of date. They do not show the results of the greatest war in history—the vast changes that have swept over the face of three continents, redistributing millions of square miles of territory—establishing new nations—drawing new boundary lines—revolutionizing the destinies of people.

Now a wonderful *new kind* of atlas is ready for you—an atlas that keeps pace with the world! Fresh from the press comes the NEW WORLD Loose-Leaf ATLAS, a superb new collection of maps that is *up to date now* and that can be *kept up to date* in the future. It is *Loose Leaf*, and it is provided with continuous Map Service that supplies new, revised maps whenever changes occur anywhere.

Here is the atlas you have been waiting for—here are three hundred and fifty pages of finely engraved, large-scale, full-color maps and indexes that show the whole new world of today with all the recent changes in every country. This great new work constitutes a source of timely geographical knowledge—a wealth of authoritative information.

Each day, as you read your newspaper, as you talk with well informed people about national and international affairs, as you follow the course of commerce at home and abroad, you will appreciate the value of the NEW WORLD Loose-Leaf ATLAS. You will turn to it, just as you turn to your dictionary and encyclopedia, to obtain exact information and to increase and broaden your store of knowledge.

### Map Service Free for Two Years

**The NEW WORLD Loose-Leaf ATLAS will be kept up to date for two years without charge. Twice each year new maps will be issued to cover all changes that have occurred in every part of the world. These revised maps are simply inserted in the Loose-Leaf Binder in place of the old maps. This new kind of atlas need never go out of date. It is the only atlas that keeps pace with the world.**

## The NEW·WORLD Loose Leaf ATLAS

### The New Atlas You Need Now
### The Last Atlas You Need Ever Buy

You need no longer be without an *up-to-date atlas* and you need not wait until additional settlements have been made in the map, for this new kind of atlas keeps pace with the world—shows changes in the map whenever and wherever they occur.

If the world never changed no atlas would ever grow out of date. But with the rapid march of current events new atlases soon must become obsolete. Even the NEW WORLD ATLAS would soon be far behind the times if no provision were made for keeping it always up to date.

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The NEW WORLD Loose-Leaf ATLAS represents a distinct advance in the science of atlas production. Never before has an atlas been made that could be kept up to date—permanently abreast of developments, of changes political and economic, of advances in commerce, of new discoveries and explorations.

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Even now, after all the changes that have taken place in every part of the globe, an atlas cannot be kept up to date unless provision is made for future changes.

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**How the new Poland appears on the map, and why its geographical position makes it an important factor in European affairs of the future?**

**What territory Germany has lost and how it has been disposed of by the Allies?**

**Where Fiume is located and why its situation makes it so important to Italy that the poet D'Annunzio seized the town?**

**What the boundaries are of the new nations of Jugoslavia and Czechoslovakia and how the populations are constituted racially?**

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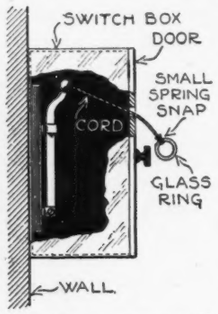
## Here Is a Safety Pull for Electric Switches

FEW people, especially busy housekeepers, seem to accord the electric lighting system a proper amount of respect. The writer has heard of instances of death, and a number of serious burns, resulting from carelessness in hurried attempts to pull the main switch in the dark.



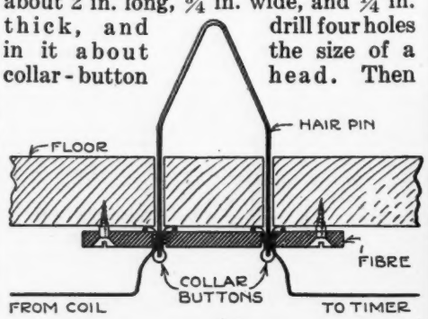

No more unexpected electrical shocks if you equip your switch in the way shown here

Since the switch-block is usually enclosed, with access through a small door, the illustration shows a method of pulling the switch from outside which cannot shock the person operating it.—ROY H. POSTON.

## The Hairpin as a Lock for the Automobile

THE lock shown in the illustration consists of a small piece of thin fiber, two brass collar buttons placed in the holes made in the fiber strip and used as binding-posts, and a hairpin utilized as the socket switch. An automobile equipped with this switch is burglar-proof (in so far as the switch is concerned) and the contrivance takes only a few minutes to make.

Procure a piece of very thin fiber about 2 in. long, ¾ in. wide, and ¼ in. thick, and drill four holes in it about the size of a collar-button head. Then

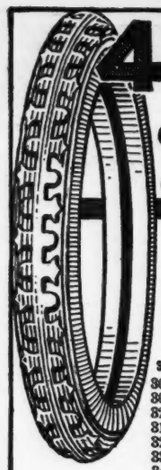



A hairpin, two collar buttons, and a piece of fiber will prevent a thief from stealing your automobile

drill two holes in the dashboard of the car close to the coil-box or in any other place preferred by the car-owner. These holes are made hairpin size, as shown.

Cut the wire leading to the timer, twist three turns of it around the collar-button, and place the head of the collar-button in the hole in the fiber. Do the same with the other end of the cut wire, and screw the fiber against the two holes made for the hairpin.

When you wish to leave the car, simply pull out the hairpin and conceal it. The thief cannot start the car, because he will probably overlook these two small holes.—C. C. KLINT.

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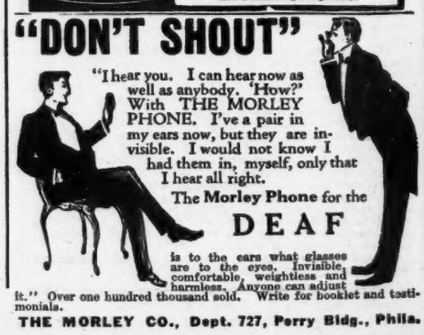

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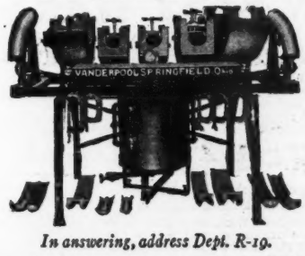


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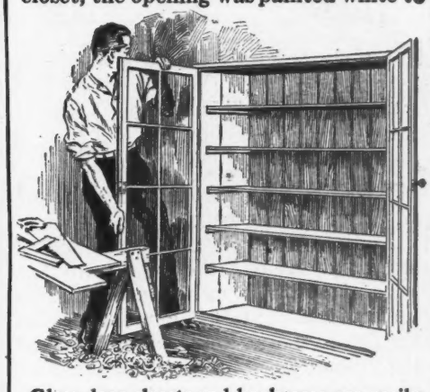
## Build a Closet in That Unsightly Hole

THE conversion of a kitchen into a dining-room frequently leaves openings not easily filled in the readjustment. A Washington, D. C., woman, while making such a transformation, discovered an unsightly aperture in the wall where formerly a bricked-in cooking range had been located.

Curtains temporarily hid the unpresentable hole in the wall until the inventive mind of a roomer in the house planned a homemade closet for china.

Preparatory to the installation of the closet, the opening was painted white to



Glass-door closets and bookcases are easily made and sometimes fill unsightly holes

match the other woodwork in the room. Then the opening was furnished with white shelves and glass doors on hinges were fitted in.

Housewives confronted by a similar problem can duplicate the achievement by assembling the following material: Five shelves ½ in. thick, 10 in. wide, and 4½ ft. long; two glass doors 2 ft. 2 in. wide and 5 ft. high; two knobs for doors; two pair of hinges; one lock; one dozen cut screw hangers; one board 1½ in. by 12 in. by 5 ft. for the top of closet; four boards 1 in. thick, 8 in. wide, and 5 ft. long for the sides; two boards 1 in. thick, 2 in. wide, and 5 ft. long to hold the doors; and 50 ft. of molding.—S. R. WINTERS.

## Heating Food and Water for Chilled Cattle

IF it is located near a windmill or a storage-tank, this homemade heater can easily be filled with water. The water is heated quickly with fuel such as cornstalks, straw, corncobs, or brushwood.

Pumpkins and potatoes help to fatten the stock, and ground feed may be cooked by pouring scalding hot water on the meal in barrels and then covering the barrels with old blankets or carpets to keep the steam in and to cook the feed slowly and thoroughly.

A light fire will take the chill from ice water and the heater may be utilized for other things, when cooking is desired. It is made as follows:

Make a frame of 2-by-8 in. pine, 7 ft. long and 27 in. wide. Put a bottom on

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3. Right-hand Ratchet
4. DOUBLE Ratchet
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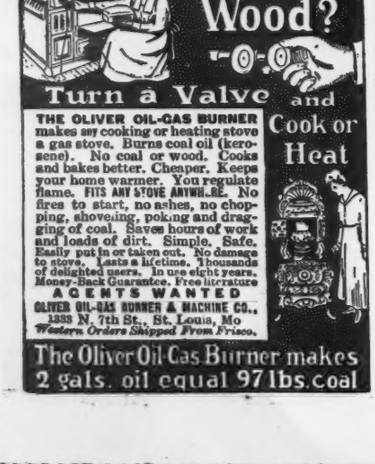
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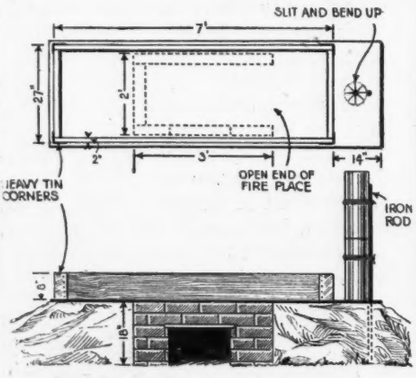
it of No. 18 galvanized iron, allowing it to project on each side and about 14 in. at one end in order to attach a stovepipe fitting. Spike the frame together, and cover the corners with heavy tin to



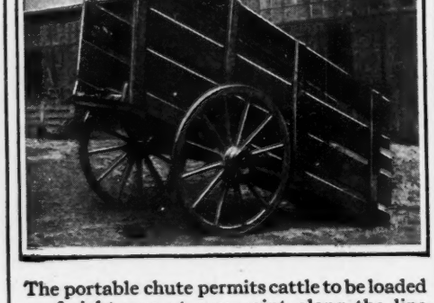

The heater will burn cornstalks, corncobs, or brushwood and it will cook any kind of cattle food

prevent leaking. Attach the bottom with two rows of nails.

Make a fireplace on the ground of stone and clay or brick and cement 2 ft. wide by 3 ft. long and 18 in. high. Pile up dirt 1 ft. high and 3 ft. long at the end of the fireplace for a flue, and put stone on the ground the same length as the piece of galvanized iron mentioned above. Place the tank on this foundation and bank it up with dirt. In cutting the hole for the stovepipe, turn up strips of the iron for a collar, then drive an iron rod through the sheet-iron into the ground. Put on two lengths of stovepipe and wire it fast to this rod. Another piece of sheet-iron should be set up before the fireplace to control the draft and keep the fire constant.—SYLVANUS VAN AKEN.

## A Portable Loading-Chute for Live Stock

ONE of the most useful things that can be included in the equipment of a live-stock farm is a portable loading-chute. A serviceable chute of this kind may be built on the front bolster of an old farm-wagon. If it is framed



The portable chute permits cattle to be loaded on freight-cars at any point along the line

with strong timbers and floored with 2-inch plank, it will be strong enough for any purpose; yet the large wheels make it easily portable from one place to another.—A. A. JEFFREY.


# When Johnny has the Croup!

**That's a cough with a croupy rattle, so hurry for the Musterole and rub it in right over the chest and neck. How it will tingle at first and then grow ever so cool. And how it will reach in and penetrate right to the spot! It will dissipate all the stuffy congestion which causes that hacking cough.**

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**Musterole is made of oil of mustard and other home simples. It penetrates under the skin, down to the part. Here it generates its own heat, and this heat disperses the congestion. Yet Musterole will not blister. Musterole, on the contrary, feels delightfully cool a few seconds after you apply it.**

**Try Musterole for Bobby and Helen and Dorothy's croup—and for your own cough, too. Try it for rheumatism—it's a regular rouster out of all congestions. Always keep a jar handy.**

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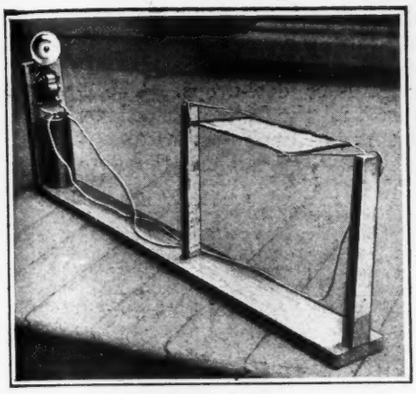
## To Make a Signal that Warns of Rain

OFTENTIMES wash hung out on the line to dry is thoroughly wet all over again by an unexpected rainstorm.

A contrivance to prevent this and similar occurrences may be easily constructed from board, a piece of cloth, some copper wire, and a bell and battery.

On a wooden base about 18 inches long nail two posts 10 inches high and 16 inches apart. From these swing a sheet of cotton cloth 12 inches long by



Is it going to rain? Don't worry about the clothes, for a bell will ring when the drops begin to fall

3 inches wide. Stiff wire is used to hold the cloth straight.

At one end of the base place a bell with its battery. This is connected with the wires in the cloth, the connection being in series. When the cloth is dry there is, of course, no circuit and the bell will not ring. But as soon as the cloth becomes wet from the falling rain the circuit is completed and the bell rings.

Such a contrivance need not be constructed all upon one base. The wire may be run into the house and the bell connected there.

This device is a boon to chicken-raisers who need to be warned of a night storm.—F. E. BRIMMER.

## Preserving Flowers in Their Original Colors

THERE are several methods of preserving blossoms in their natural form and color. If attention is given to details, very good results can be secured. One method is carried out with the use of sand. For this purpose a wooden framework is needed. This is easily made by knocking the top and bottom out of a good sized box about seven inches deep.

Across the bottom of the woodwork, just inside the edge, fasten a piece of wire netting. If the wire netting is a trifle larger than the frame there will be a sufficient border to turn round. Small nails may be used for fastening the netting. A flat piece of

*GUARANTEE—We guarantee Hanes Underwear absolutely —every thread, stitch and button. We guarantee to return your money or give you a new garment if any seam breaks.*

# "Hanes"—greatest underwear value ever sold at the price!

GET the big, *extra*-long-service features of Hanes winter men's Union Suits and Shirts and Drawers fixed in your mind! Go over the *extra*-wear-points brought out in the diagram circles shown in the Union Suit above—*guaranteed* unbreakable seams; *guaranteed* tailored collarette that cannot gap; *guaranteed* elastic knit wrist and ankles; *guaranteed* closed crotch; *guaranteed* pearl buttons sewed on to stay; *guaranteed* buttonholes that last as long as the garment!

Such a wealth of underwear value to spread before any man at the price! If comfort, warmth, wear and economy mean much to you in winter underwear, then buy "Hanes"! *Every thread, stitch and button is guaranteed!* You should immediately check up your dealer and get a supply.

Hanes winter weight Union Suits are standard throughout America —*standard* because of extra wear and *standard* because their extra comfort, fit and perfect workmanship make them exceed in real worth any underwear you ever bought at the price!

Your confidence in Hanes Underwear should be based on the fact that every process of manufacture from raw long-staple cotton to the perfected garment is *under direct Hanes supervision in Hanes factories!*

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All the quality, extra features and perfect workmanship that make Hanes men's Union Suits so universally popular *go right into Hanes Union Suits for Boys!* We have never laid hands on such value in boys' underwear. Fleeciness and warmth, in particular, meet parents' most exacting wishes, plus *reinforced buttonholes* that will not stretch.

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wood will be required on which to stand the frame, with the netting side down.

### *How to Clean the Sand*

Now secure a quantity of sand. It is of the utmost importance that this should be absolutely clean. To clean it, place the sand in a large bowl, and pour water over it until all foreign matter has been washed away. When the sand is quite clean, spread it out on a tray to dry. The quickest way to do this is to place it in the sunshine or in front of a fire.

Almost any kind of flowers may be preserved with sand. Those with the brightest colored petals give the best results. White blossoms are not so satisfactory, coming out a dirty yellow color. All the flowers should be free from rain- or dew-drops. The first step is to fill the frame with a layer of sand that just covers the wire netting. On this sand spread out the flowers.

Almost any kind of flowers can be preserved with sand. The brightest colored ones give the best results

Blooms that are cup-shaped should be filled in with sand in order to preserve the form. The flowers should not touch one another.

When the sand is covered with blooms, cover the flowers with a layer of sand. You may then place a fresh layer of flowers, treating them in the same manner. Sometimes three layers of flowers may be worked into the frame, but generally speaking the best results are secured with only two.

When the frame is full, place it in the sun, or on a shelf in a warm dry room. At the end of ten days the flowers may be considered to be dry. Lift up the frame from the board, and the sand will slip through the netting, leaving the flowers in a heap. For the first hour or so they will be very brittle and should be handled with care. After exposure to the air the blossoms soon become durable.

### *The Sulphur Box*

Very good results may be obtained with the sulphur box. Any strongly made deep box will do. In the lower part of the box at one end cut an opening large enough to push a saucer through. On the piece cut from the

box nail another piece half an inch wider all round, to be used in closing the opening. In the other end of the box bore a hole into which a cork may be fitted.

After arranging the flowers, light a few lumps of sulphur in a saucer, push it into the box, and remove the cork at the other end of the box. Leave both ends open for a few minutes, then close up tightly and leave for twenty-four hours.

This process bleaches the flowers, but after a short exposure to the air they regain they natural tints.

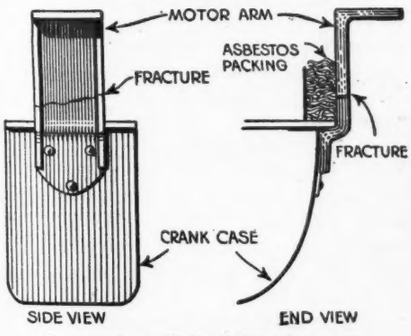
### *The Wax Treatment*

Another plan that acts very well in the case of many flowers is known as the wax treatment. The first step is to secure a tin or iron pan, and into this put a number of chunks of candle-wax, taking care not to let any of the wick get in. Melt the wax over a fire, and then dip the flowers in the liquid, one by one. Leave the flower in the wax for not more than a moment. Then take it out and wave it gently in the air. The flower is covered with a thin film of wax that keeps out the air and prevents decay. —S. LEONARD BASTIN.

## To Repair a Crankcase Arm without Removing Engine

BY the following method a Ford crankcase arm, which has been broken, may be repaired in an hour's time without removing the engine from the car.

Hoist the car up to an angle of 45 degrees by means of blocks attached to the wheels on one side. Pack the

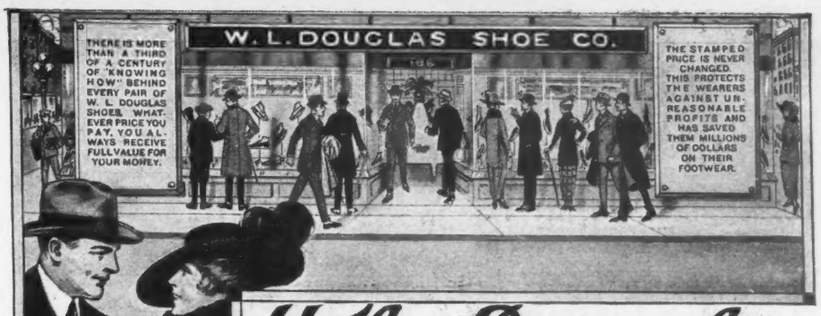



One of those little things that every Ford-owner ought to know about

fracture and surrounding parts with asbestos packing to prevent their being damaged by the excessive heat, and weld the arm with an oxyacetylene torch.

It is sometimes necessary to jack up the crankcase before welding in order to spring the fractured member into place, but this is an easy matter.

While the accessory market has a number of patented devices that serve this same end, the repair herein described answers the purpose and saves an otherwise necessary trip to the local repair station. — PAUL L. FETHERSTON.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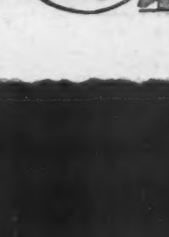

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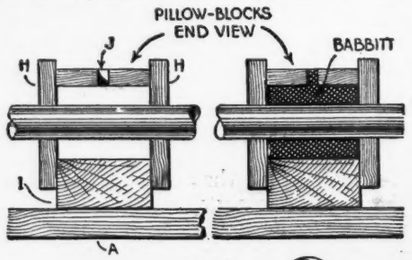
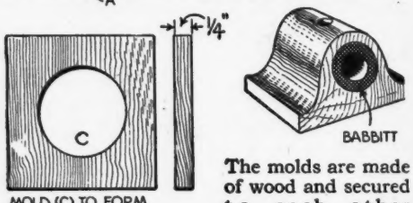
SUPPOSE that you wish to provide babbitt bearings for a vertical shaft which is to extend between and above the bed-plates of a machine. Holes *E E* are bored through the wooden bed-plates *A*. The diameter of these holes may be ½ in. or more




MOLD (C) TO FORM UPPER AND LOWER FLANGE (D)

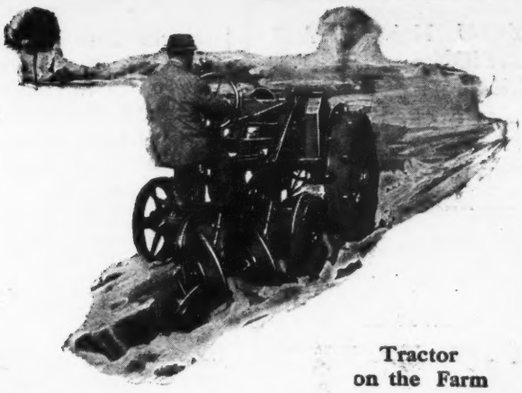
The molds are made of wood and secured to each other by small nails

greater than that of the shaft. Cut two wooden blocks from ¼-inch board and in these blocks saw circular openings of a diameter to correspond with the upper flanged part of the finished bearing *D*. With small nails, secure these blocks *C C* to the bed-plates.

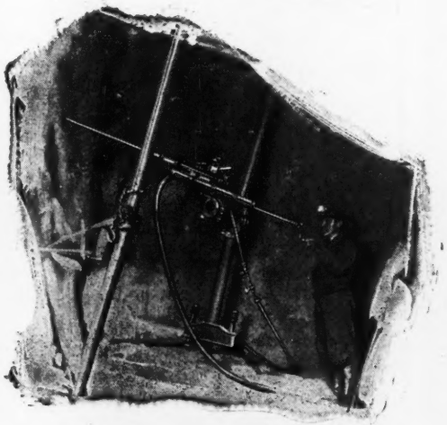
Anchor screws *F* are driven into the bed-plates until their heads stand in line with the surface of the blocks *C C*. Shape two blocks *B B* from inch material and drill a hole in each block the exact diameter of the shaft. Nail or clamp these blocks to the bed-plates. These form the bottoms of the molds and are placed so as to hold the shaft in a central position with relation to the mold. Nail the lower block on first, then the upper one may be carefully adjusted until the shaft is in a vertical position as determined by using the steel square. If, for any reason, the molds are not tight at the bottom, a little asbestos or putty may be tamped in.

One layer of very thin paper must be pasted around the shaft at the points where the metal will flow. The shaft is first placed in position as shown in the illustration, and then the papers are wrapped around it. The distance between the lower edges of the papers must be equal to that between the bottom lines of the bed-plates *A* The shaft is then carefully lowered until the papers reach the blocks *B B*.

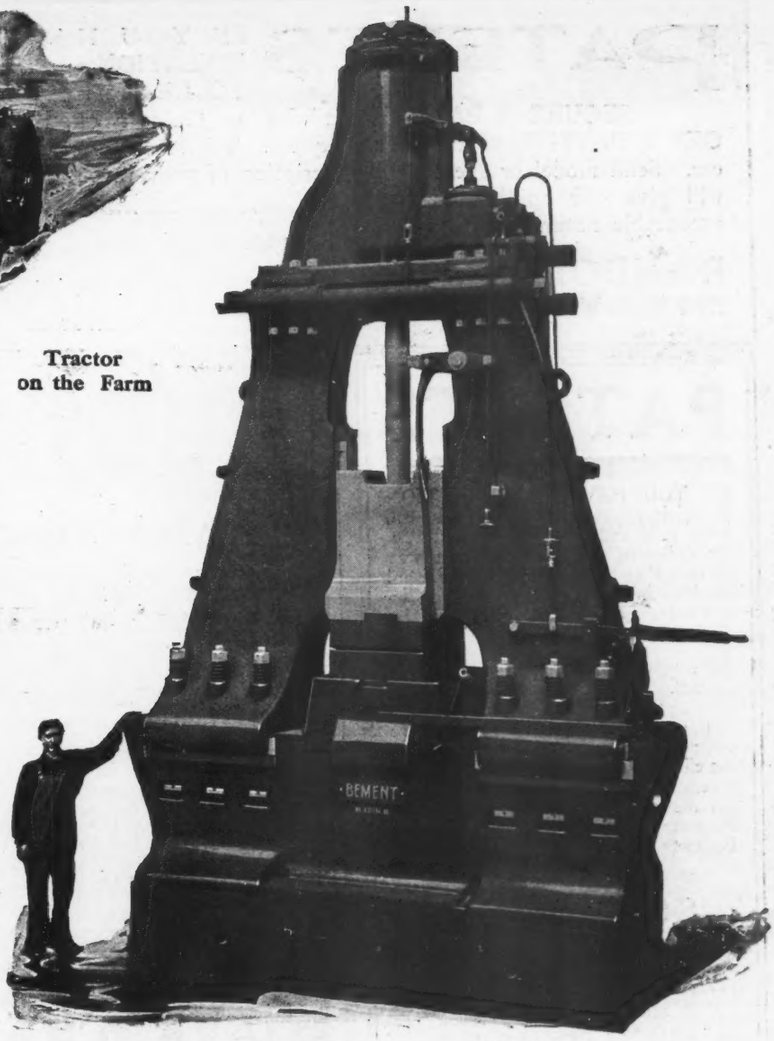
Old type metal may be used for babbitt metal. It can be melted in a baking-powder can with the edge bent to form a lip, and having a wire twisted around the can to form a handle. If the point where the bearings are located is inaccessible for pouring, a V-shaped trough may be shaped from heavy wrapping paper. Since the metal



Tractor on the Farm



Pneumatic Rock Drill in the Mine

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# PATENTS

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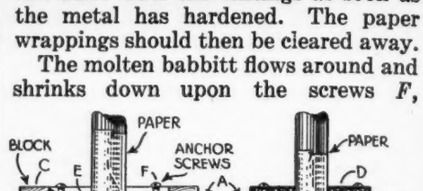
**WATSON E. COLEMAN, Patent Lawyer, 624 F St., Washington, D.C.**


shrinks in cooling, it is best to remove the shaft from the castings as soon as the metal has hardened. The paper wrappings should then be cleared away.

The molten babbitt flows around and shrinks down upon the screws *F*,




One layer of a very thin paper must be pasted around the shaft at the points where the metal will flow

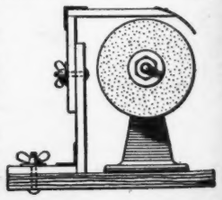
which saves you the trouble of drilling screw holes. It is necessary to tighten the screws when the metal is cold.

If the shaft is not to extend beyond the lower bed-plate, a metal plate *G* may be screwed to the bed-plate to receive the weight of the shaft.

Pillow-blocks for a horizontal shaft may be made in a similar manner. The perspective view shows a pillow-block made from wood. The sectional view shows a pair of blocks ready to receive the molten babbitt. Blocks *H H* are screwed or clamped to each face of the pillow-block *I* and the metal poured through drilled holes at *J*.

## Two Methods of Protecting an Emery Wheel

THE illustration shows how a simple guard can be constructed for an emery wheel. The improvement of this design over the regular style is that it can be adjusted for the kind of work to be performed and also reduced as the size of the wheel diminishes.



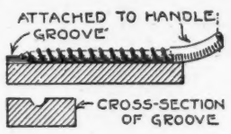
The guard is adjusted in the manner shown

Slots in the base and uprights of the guards and a winged nut provides for prompt adjustment.

Another feature found worth while is to use a very flexible material as a front hang-piece; a thin piece of leather or heavy paper will do. While it may seem to rest on the wheel when not in motion, as soon as the wheel starts to revolve, a current of air raises it just enough to clear the wheel. It is a perfect guard against sparks and small particles of steel.—J. C. GRINDELL.

## A Homemade Groove-Cutter for Oil Bearings

IT sometimes happens that a mechanic desires to cut a round groove in the surface of some metal such as brass, aluminum, or other alloy. This may be done quite readily with the simple device here illustrated, if there is no special machine at hand to do this work.




A satisfactory oil groove bearing can be made with this device

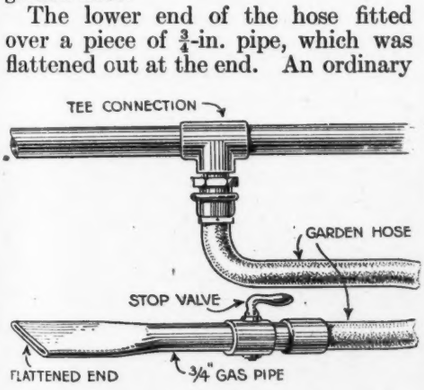
The device consists merely of a new wood-screw soldered or welded to a sort of handle, as shown. The screw is selected according to the size of the groove to be cut.

To operate, press the screw down on the metal and pull it back and forth along the line where the groove is to be cut. Press it gently at first, increasing the pressure as the metal is scraped out. If possible set the object to be grooved at an angle so that the filings will roll off.—DAVID BAXTER.

## You Can Start Your Furnace with Gas

BUILDING a fire in the furnace was a difficult task for a certain resident of Elkhart, Ind., until he hit upon a novel, yet extremely simple, expedient. He hired a plumber to insert a three-way knuckle in the gas-pipe, which ran under the floor and above the furnace. To the outlet he attached a length of ordinary garden hose.

The lower end of the hose fitted over a piece of ¾-in. pipe, which was flattened out at the end. An ordinary




Spraying the coals with flame from the gas-pipe results in a quick and sure fire

stop-valve was fitted into this lead section of pipe. The gas streaming from the section, when lighted, produced a wide, flat flame. This, inserted in the furnace under a pile of kindling, created perfect ignition.

The device did away with the necessity of kindling, the flame quickly igniting a filling of coal.

During the fall and spring months, when fires are started in the furnace just to take the chill off, and are then allowed to go out, this idea is exceedingly practical.— CHET SHAFER.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# *For the Radio Experimenter*

## Running Trucks by Radio

### Why not direct your motor trucks like ships?

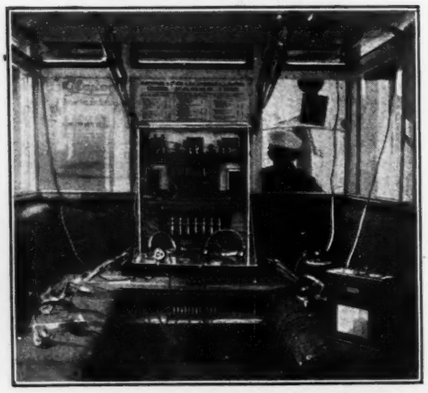
**By Lloyd E. Darling**

The instrument load packed up for a long trip across rough country

IT is quite possible that radio may soon be called in to make motor-truck haulage even more efficient than it is. Many factors point in this direction. Direction-finders, electron-relay sending and receiving apparatus, and all the related appliances have been marvelously improved within the last two or three years. Already they are directing the movements of ships at sea and in harbors. It is only logical to conclude that they have the same field for operation in directing the travels of fleets of motor trucks on land, since motor-trucks travel about, and are hard to reach in cases of emergency, just as are ships. Yet they need to be kept filled with "cargoes" and at all times routed most efficiently, or they lose money—again, just like ships. So the stage is all set for the advent of radio in the motor-truck field at this time.

Some interesting experiments were recently conducted in the suburbs of London, England. The apparatus used was a form of the pack and wheeled radio set developed originally for use in the British army. Tube transmitting apparatus was loaded on a truck, and the vehicle sent on a rambling run through London suburbs under sealed orders, provided, for the sake of the experiment, by the mayor of Colchester. Arriving at a spot fixed in the orders, the operator on the truck began to send out certain radio signals for the benefit of direction-finding apparatus in towns near by.

These direction-finders promptly showed which way the truck was from their respective stations. Their operators "radiotelephoned" the information to a centrally located control station, which promptly marked the angles on a map—in much the same way as for ships entering harbors, described in the POPULAR SCIENCE MONTHLY for September, (page 116). The lines thus marked on the map all intersected at one point, obviously showing the location of the truck that had gone off and hid itself, under the sealed orders.

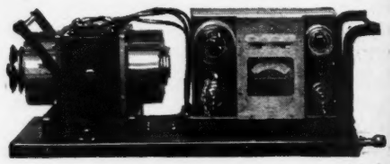


The bus operator may call up his home office at any moment for instructions

The buses use a loop aerial affixed to the outside in the manner shown

The control station operator then called up the mayor of Colchester (again by radiotelephone, for the mayor, with a party of engineers and others interested in the experiment, were themselves riding around in the motor-bus shown in the illustrations on these pages) and asked the mayor whether the location of the hidden truck, as determined by the direction-finding apparatus, was correct and according to what he had specified in the sealed orders. He replied that it was, exactly. This proved the success of the experiment. In effect, a truck-owner had been able to locate his truck while he was riding around in another vehicle, an even greater achievement than one would ordinarily be called on to perform.

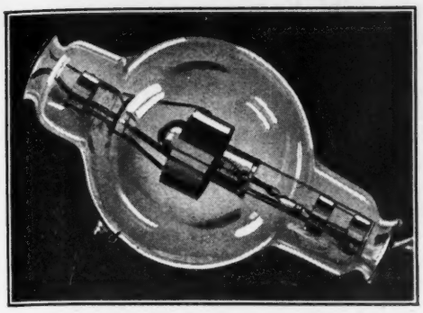
American radio men have already extensively experimented with radio apparatus on trucks, automobiles, limousines, and in fact almost every wheeled vehicle of the kind. But the commercial value of keeping such apparatus permanently on such vehicles has not so often been emphasized. Doubtless much more such experimentation will be made in the immediate future.



Generator end of pack apparatus. It fits on the tripod in the illustration below

The tests of the English experimenters are indicative of a trend of thought and a development in progress in all countries where both automobiles and radio are highly developed. Obviously, any good radio apparatus should be capable of producing as good results as that illustrated herewith.

Here is the apparatus from which the outfit that was used on the London buses was developed



An English electron relay. Note that the grid resembles a gas mantle

Many radio students possessing sufficient apparatus may be interested in seeing what they can do in the way of developing an efficient system for use in motor-vehicle service. There is a large future in the line.

Eventually, of course, this great country will be crossed and recrossed by a network of permanent roads. Motor-vehicles carrying freight or interurban passengers will be as common as horse-drawn vehicles are now. Already we have made considerable progress along this line, especially in the neighborhood of big cities. But the largest problem the owner of a fleet of motor-trucks has is to keep them full at all times, and to prevent them from going on useless journeys, or from crossing and recrossing one another's paths—duplicating effort, in other words, and half loaded at that. When a centrally controlled system of load-dispatching is inaugurated, operated by radio, a large share of these wastes can be done away with. This will mean thousands of dollars' gain to the larger truck-owners.

Thus the owner of the future will be able to issue orders to his trucks, directions for picking up return loads, instructions as to where to go for repairs or gasoline when there is trouble en route, or other information of the kind

All of this will speed up results immensely. Radiotelephones work over distances of two or three hundred miles now with ease. They have, in fact, talked as far as from New York to Hawaii, for that matter, or from New York to the British Isles. Much is possible in these coming years.

Generator load ready for army transport. Additional horses carry aerial and the rest of the paraphernalia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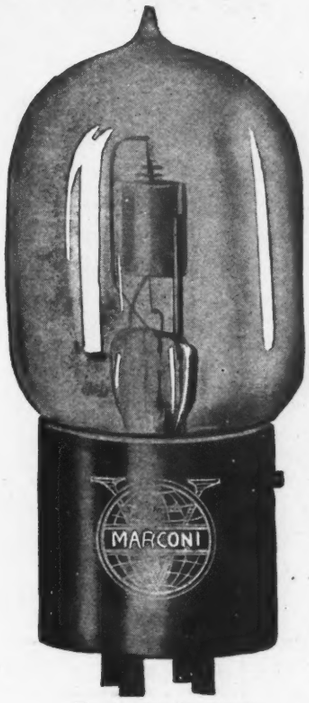


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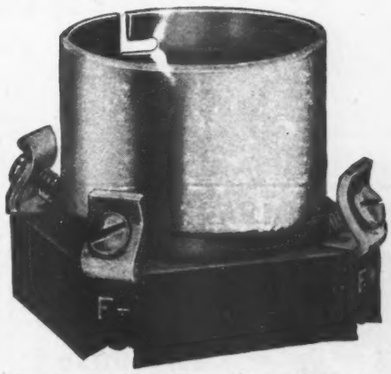

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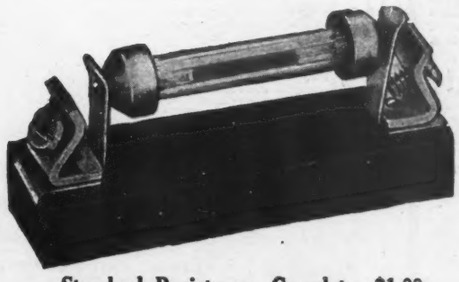

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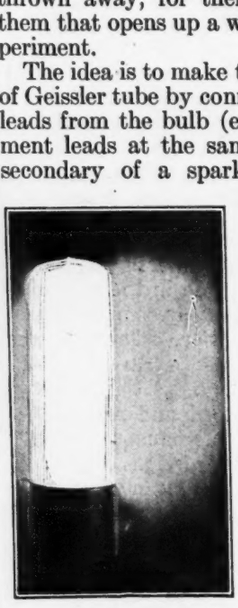
## Make Old Vacuum Tubes into Geissler Glow Lamps

VACUUM tubes usually last about a year and a half. Even after this good service they need not be thrown away, for there is a use for them that opens up a wide field for experiment.

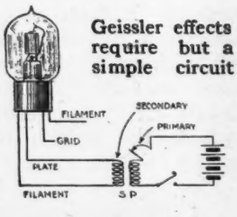
The idea is to make them into a sort of Geissler tube by connecting any two leads from the bulb (except both filament leads at the same time) to the secondary of a spark-coil, small or large. Since the tubes are highly evacuated, a pleasing light will be seen inside the tube. Different effects may be had by pasting a small piece of tinfoil about one inch square up about the middle of the glass and connecting one secondary lead to this and the other to either of the filament leads or to the plate or grid. Since the plate is nearest the glass, the tube gives most light when it is one of the electrodes.



Tubes glow beautifully in the dark

Instead of tinfoil, a loop or coil of one or two turns of bare or insulated wire may be wrapped around the tube, and the secondary lead connected to the loose end of the wire. If one lead is connected to the plate, grid, or filament, and the other lead grounded, the bulb will light, though not brightly. In fact, there are countless experiments that the live amateur can devise with this simple bulb and coil connection.

One advantage of the idea is that even a small ¼-inch coil will run the tube very well.




Geissler effects require but a simple circuit

An interesting line of experiment is to take pictures of the light emitted by the tube. The best way is to take the photograph in the dark and let the glow of the bulb, only, register on the plate. The camera should be focused before the lights are turned off. The bulb should then be put in operation, and an exposure of about seven minutes will be found to be correct, though this varies with the strength of light emitted.

The photograph herewith shows some of the various effects produced by an old Fleming valve of only two elements. The picture really does not do justice to the beautiful light produced. It is of a weird blue color, and

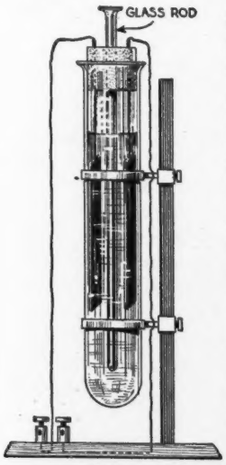
fills the whole tube like a firefly glow. When taking pictures of this kind, the spark-coil and batteries and switch should be placed behind the camera so the spark of the vibrator will not take in the picture.

In experimenting with these tubes, sometimes one gets a bright blue light with a strange Northern Light movement going on inside the glass. This is characteristic of Geissler tubes. Again, the light is broken up by a single beam, brighter than the rest, which twirls about between the plates, one end turning on a fixed spot as an axis, and the other end revolving around the edge of a plate.

To test this light between the two plates, run the bulb steadily for twenty-five minutes. At the end of that time the glass will retain exactly the same heat as at the start. This is because the light produced in a vacuum is somewhere near that great degree of perfection, cold light. With certain circuits, however, the tube sometimes gets hot. Sometimes light from a tube is stratified or in bands. This cannot be perceived so well with the eye as with the camera. —PHILIP A. WALL.

## Use a Water Rheostat to Control the Filament

A WIRE rheostat of ten or more ohms resistance is ordinarily used to control the temperature of the filament in an electron relay or vacuum valve. If one is not readily available, however, a rheostat may readily be made of a test-tube, some salt water, and odds and ends of wire.



A test-tube makes a simple rheostat

The assembly is shown in the figure. Pushing the glass rod down through the cork causes the liquid to rise in height, and thus decreases the resistance between the submerged electrodes. Pushing the glass rod down, therefore, means that the filament of the electron relay will get brighter. The water rheostat is inserted in series with the battery and the filament. Binding-posts on the baseboard make connection easy.

Salt and water will do for the liquid in the test-tube. Ions of another substance must be present. Salts or an acid will provide these.

The electrodes within the solution may be made of almost any metal but those that do not corrode easily are best.— A. A. MACKUSICK.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# Ridding Radio of Static

**By Greenleaf W. Pickard**

*The following article comprises excerpts from a paper, "Static Elimination by Directional Reception," delivered recently before the Institute of Radio Engineers, New York. Aside from being an experimenter of note in this field, Mr. Pickard also holds several fundamental patents on crystal detectors, and is one of the real pioneers in the radio art. Toward the end of the paper Mr. Pickard tells several facts heretofore unknown about the workings of the mysterious receiving station that the Navy operated at Otter Cliffs, Maine, during the war. Altogether the paper is of much interest and value to radio students. It will be printed in full in the Proceedings of the Institute of Radio Engineers shortly.*—EDITOR.

THE writer's theory of static might be summed up as follows: According to the assumed character and location of the discharging masses, static waves may be expected to come in on the receiving stations from all angles in altitude and azimuth, with a maximum individual intensity from above, and a maximum frequency in the neighborhood of the horizon. The total disturbing effect will in general come in from points nearer the horizon than the zenith, although the altitude of the ring of maximum disturbance is indefinite. The individual planes of polarization may take all possible angles, but with a preponderance in a direction determined by the earth's magnetic field. Finally it would seem that the most probable static wave form was a single highly damped pulse, because of the low conductivity of the discharging masses.

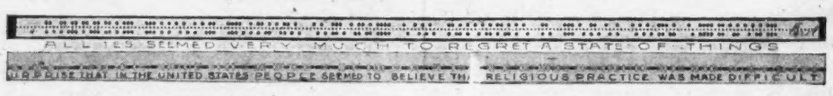
### *Like Receiving Light Signals by Day*

According to the above theory, the problem of the elimination of static and the preservation of the signal consists simply of the reception of a wave-train originating at all points in altitude and azimuth. In a broad sense, there are two solutions for this problem, one involving a separation of signal and static based upon their difference in wave form, and the other a separation based simply on sharply directional reception.

It is quite clear that if we could restrict reception to a small, solid angle, including the distant station, there would be relatively little static included. To use an optical analogy, the problem is essentially like that of receiving monochromatic light signals in full daylight. A spectroscope or a filter screen would be one solution, and directive reception as by a telescope another, but best of all would be a combination of the two. In present-day radio communication we have already highly developed the spectroscopic or filter separation of signal from static, as by sharply resonant circuits and beat reception. But, although we have had two practicable types of sharply directional receiving circuits for the past twelve years or more, very little use of these appears to have been made until quite recently.

### *History of Directional Reception*

The first method of obtaining sharply directional reception was originally suggested by Elihu Thomson in 1899, was patented in England by S. G. Brown in the same year, was more fully disclosed and patented in this country by Stone in 1902, was elaborately worked out for two, three, and four collecting circuits by Braun in 1906, and, more recently, was used by Weagant. Two or more separate collectors are employed, spaced apart a material fraction of a wave-length in the line of propagation. These collectors act upon a common secondary circuit in such wise that, when the collectors are simultaneously affected by any disturbance, the currents set up therein will arrive in phase at the center of the system, and there, by opposed windings, be placed 180 degrees apart in phase in their effect upon the secondary. Because of this opposition, such currents will not affect the detector, and no signal will be produced. On the other hand, the signal wave, passing the collectors successively, will set up currents therein which will arrive at the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Otter Cliffs relays messages to Washington, using the upper tape. Lower tape shows how a message from Europe looks as received on an automatic machine

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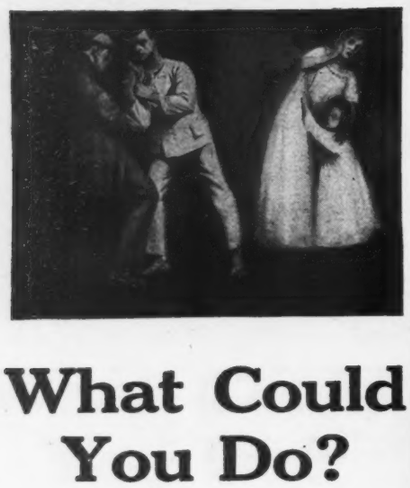

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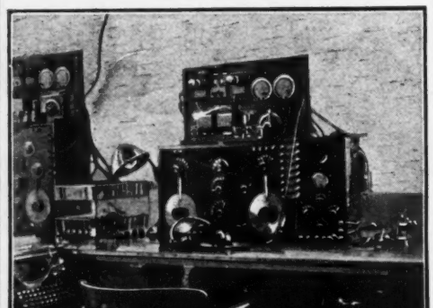
center of the system in an out-of-phase relation, and such signal currents will add in their effect upon the secondary and affect the detector. This is very well shown in the Stone patent.

The writer in 1905 devised a system in which two aerials, tuned to the distant station and separated on centers by some thousands of meters, were connected to a common secondary by way of phase-adjusting means, so that the currents were added in the secondary in such phase as to produce the maximum signal. This method was first published in a patent filed in 1907.



Naval receiving apparatus within the isolated houses, Otter Cliffs station. Mr. Pickard's circuits helped elimination of static here

The particular case discussed in this publication involved two large loop or coil aerials, arranged in an east-and-west plane for the purpose of trans-atlantic reception. These loop aerials consisted of long, low rectangles, and were tuned to the desired wave-length by inserting series capacity and inductance. With this system it is possible to so adjust the phase relations of the currents arriving at the secondary that interference or static arriving from any particular direction is canceled out in the secondary, and does not affect the detector. A further advantage of this system, which has recently been pointed out by Weagant, is the fact that it has materially greater or sharper directional reception than any single type of collector.

The second method of directional reception devised by the writer does not involve, even for long wave reception, such geographical dimensions as the other systems. This second method consists simply of a closed tuned circuit or coil aerial, of dimensions small as compared with a wave-length. In its most effective form, consisting of a coil aerial combined with a so-called "open" aerial, this method gives true unilateral reception. The coil may be of quite small dimensions, particularly when it is employed simply as a radio compass. The first portable radio compass in existence was employed by the writer in 1907-1908 for mapping out the wave-front around a transmitting station. This radio compass consisted of a three-turn loop, one meter in diameter, shunted by a variable air-condenser and a crystal-detector.

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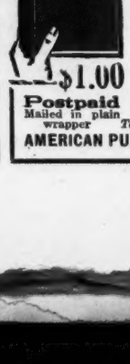


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tics of aerials have been studied principally, if not exclusively, in the horizontal plane. Just why radio engineers have elected to live in a two-dimensional world is rather puzzling.

[Much valuable technical discussion follows at this point which the POPULAR SCIENCE MONTHLY is unable to reproduce because of space limitations.]

### *Origin of Otter Cliffs Station*

Shortly after America entered the war, a radio station was built for Mr. Alessandro Fabri at Otter Cliffs, near Bar Harbor, Maine. When the station was completed Mr. Fabri donated it to the Navy, and it was first used as a low-spark station. However, it was very shortly found that the location was an excellent one for transatlantic receptions, and this eventually became its principal service.

The summer of 1917 having shown that although the Otter Cliffs station had excellent signals, it also had overwhelming static on occasion, Mr. Fabri invited the writer to install directional receiving circuits for static elimination. A circuit was installed, combining open antenna reception with loop or coil reception. This was immediately found successful.

Continued use of this circuit at the Otter Cliffs station disclosed the fact that the earth connection of the open antenna was not attached symmetrically to the aerial, the result being that a certain amount of current in the open circuit was flowing directly through the loop and connected coil, of course 90 degrees out of phase with the loop current. This tended to decrease the sharpness of the unilateral reception.

Considering only the horizontal plane reception of a simple loop aerial, with a certain unbalanced capacity to ground (either by way of unbalanced leads or unsymmetrical construction of the loop itself), it is obvious that the system will act as a combination of loop and open antenna, with the currents added together, not in phase, but in quadrature. As a result of this, the currents will add together irrespective of their direction, with the result that the ideal figure-of-eight reception curve degenerates into an hour-glass-shaped figure. The remedy consists in balancing the loop to ground, as by a three-plate variable condenser. By turning this loop through 180 degrees in its own plane, so that its terminals come out on top, a material advantage results in direction-finding.

The combined loop and open circuits have been in daily operation, summer and winter, over a period of nearly two years at Otter Cliffs, and have proved consistent performers. During the summer of 1918 the Otter Cliffs station circuits gave unbroken copying of the European stations at times when all other Atlantic coast receiving points were helpless.

# Will Captain Smith return to Floorwalking?

**There are thousands of men like Captain Smith who, before the war, were occupying relatively unimportant positions in the business world. Then, in a few months after the call to colors, they were holding commissions in the army. Millions of others found their way from positions in all walks of life into the various camps, where intensive training quickly turned a nation of business men into the world's finest fighting machine. It almost seemed incredible—but what this array of business men and workers did as "their bit" is now history. What took Germany forty years to prepare for was done in a few months by America. This record was made possible only by *intensive training*.**

**After seeing what a few months of intensive training did for him from a military standpoint, he, and thousands like him, are going to avail themselves of the same method as a means of self-betterment in business life. There's proof below that it's the only way to secure promotion and much better pay.**

Though Captain Smith may return to his old job of floorwalker, it will be only for a short while—time enough to complete a course of intensive training in some line or other that will make him mentally fit for a better paid and more responsible position. He knows that intensive training will do this for him just as surely as it qualified him for a commission in the army. Intensive training made him a leader of men. It enabled him to give orders instead of taking them. It enabled him to think, act and reason for himself and do the thinking for those under him—often a matter of life and death. No! Captain Smith couldn't be content in his old job, because he knows how to get a better one.

## *The War's Great Lesson*

Every man who stepped from his job in civil life into an intensive training camp has learned a valuable lesson—a lesson that will make him a better business man if he but has the will to win. These men have witnessed the wonders of intensive training—have seen the metamorphosis in their own individual lives as well as in those of others, and it is but natural to assume that, if intensive training in military matters performed such wonders, it must have the same beneficial effect when applied to business. The history of business and of business successes points unerringly to the assistance rendered by intensive training.

Since the armistice was signed, and more particularly since the American troops began to arrive home, there has been a noticeable increase in the number of enrollments for intensive business training in all lines of endeavor taught by the American School. Thousands of men who were simply "getting by" instead of "getting on" before they joined the colors, have learned a lesson and they are not going to be content with the poorly paid jobs they held in the past. This fact is proved by the great increase in students who are availing themselves of American School training. In a few months these students who are now applying intensive training as a solution of "how to get on," will be able to qualify for the goal they have in mind. The spare time hours they devote to this training will bring them rich rewards in the form of bigger pay checks, better positions and more congenial work. The result of such training cannot be otherwise, for trained men are the scarcest commodity on the market.

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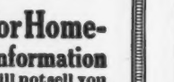

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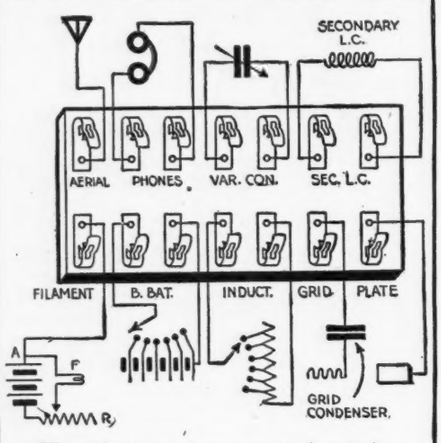
## This Universal Hook-Up Adapter Saves Wear

HE is an unusual radio enthusiast who isn't always trying one hook-up after another. But this wears binding-posts, and in time destroys them. By transferring all the hooking-up operations to a central board,




The adapter acts as a central switchboard where all hook-ups may be tried

however, all this trouble and loss may be avoided.

To make such a "hook-up adapter" board, mount a number of clip binding-posts from old dry batteries in the manner shown. Bakelite, hard rubber, slate, fiber, or even dry shellacked wood, may be used as the base material. Connect the various pieces of radio apparatus to this central board as indicated in the diagram. The connections should be well soldered to minimize losses due to loose and corroded wires. The wires may be led in from below, or in any other good manner. If it is not desired to solder the wires, small binding-posts affixed to the clip binding-posts may be provided for firmly receiving the wires.

Once the pieces of apparatus are well connected to their respective clip binding-posts, the matter of trying different hook-ups is simple. All that one has to do is to thrust wires through the clips and in this way connect whatever groups of clips the particular hook-up calls for. This may be done very speedily, and as quickly torn down ready for some other connection. As is evident, this is all done without any wear on the various instruments' original binding-posts.

If one has a collection of old jacks from a telephone switchboard, these may readily be installed in place of the clip binding-posts here shown, and make even a neater product. All permanent connections will then be on the rear, and the whole board will take up much less space.

Plug in on the various jacks to make the temporary connections wanted, just as would be done on a telephone switchboard.—RAYMOND B. WAILES.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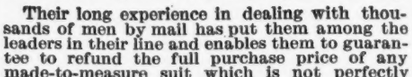

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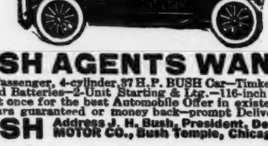

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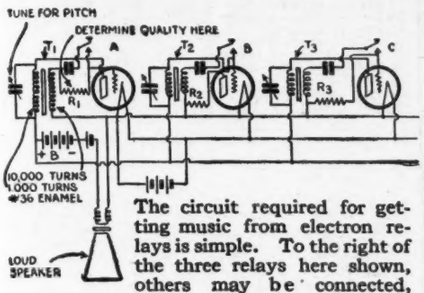
## How to Get Music from Electron Relays

ONE line of experimentation that the average radio student has not gone into thoroughly is the getting of music from electron relays—or, to call them by their older name, vacuum




**The circuit required for getting music from electron relays is simple. To the right of the three relays here shown, others may be connected, using the bottom leads**

tubes. The field is wide, and many interesting results can be secured.

Herewith we present a wiring diagram prepared for us by Dr. Lee De Forest, the inventor of the audion, or original three-electrode electron relay. Three or four years ago he did some work with the musical aspect of audions, and he finds the circuit here given excellent for this work.

Every worker with electron relays knows that under certain conditions the tubes make weird noises in the receivers. Sometimes these take the form of humming, or whining, or squealing; again they imitate a distant organ, a violin, or some other instrument.

What is not usually realized is that the sounds are controllable; that is, instead of these tones sounding at random, and according to no law, it is possible to produce th_m at will and according to a definite plan.

In the diagram herewith three electron relays, *A*, *B*, and *C*, are shown. Each has the same circuit. It is to be understood that other relays with identical wiring are to be connected to the right of the three shown, and to the same three leads those running horizontally across the drawing just beneath the row of relays.

The idea is that each of the relays so connected is to be adjusted to give a certain pitch. If we have eleven relays, that is enough to make an octave and a half (seven notes to an octave), which will be sufficient to play all ordinary tunes. If the player desires "A" to sound from the loud speaker, he depresses the key at *A*. If he wants "B", he depresses *B*, and so on. By simply fingering the keys in this way, the operator plays tunes, just as he would with one hand on a piano.

To tune the several relays for the pitches desired, adjust the variable condenser marked "tune for pitch." Of course the particular condenser so marked in the drawing only affects the adjacent relay; but the corresponding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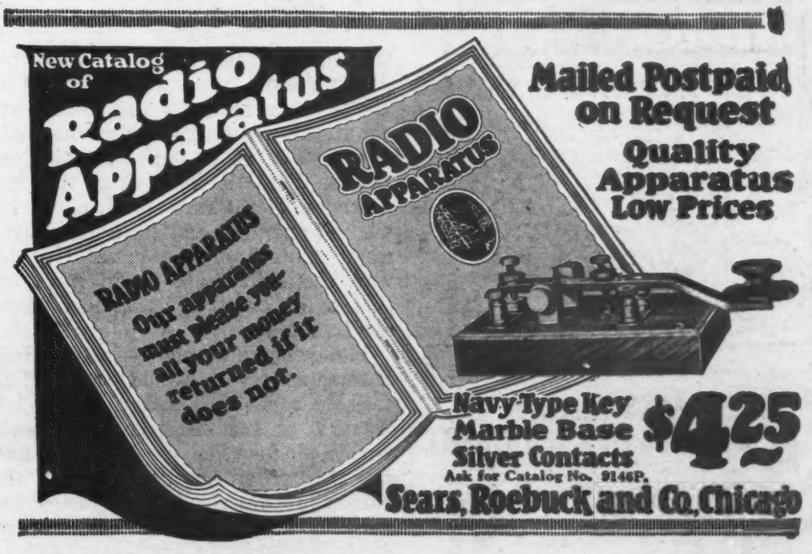

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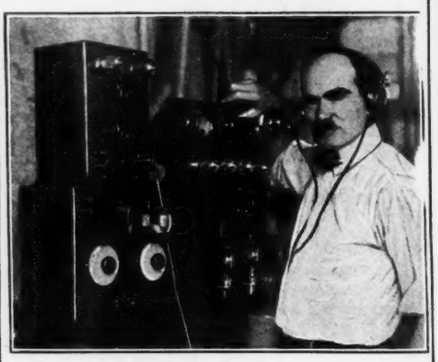
condensers in the other cases affect their respective tone-producers. A slight movement of the condenser handle has a marked effect on the pitch produced in each case. It is therefore possible to tune with considerable accuracy.

The most remarkable feature about the arrangement is, however, that



Dr. Lee De Forest. Here he is operating a new form of radiotelephone he has invented. It gets its power from a lamp-socket.

altering the resistances $R_1$, $R_2$, $R_3$, and so on, has a marked effect on the *quality* of the tone each relay produces. The "quality" of a musical note relates to the number of overtones present; that is, the number of harmonics over and above the fundamental note. It is this factor "quality" that enables your ear readily to distinguish between the notes coming from a piano, a violin, a flute, a whistle, a pipe-organ, or any of the other musical sound-producers—this even though the notes emitted by the several instruments have the same pitch.

In other words, by sliding the handle on the resistance $R_1$ along in the case of relay $A$, this relay can be made to give off a note resembling that from a whistle, a violin, an organ, or a variety of other instruments—this even though the adjustment previously given the condenser on the left keeps the relay at a certain fixed pitch all through the other operations.

Of course, the quality of the notes emitted by the other relays can be altered by changing their respective $R$ resistances also. By mounting all the $R$ resistances on one board and connecting them together mechanically so they can all be varied together and at one time, it is obvious that the character of the music emitted by the whole apparatus can be altered by a single motion of the hand. In this way the shift from violin music to that of an organ or other instrument can be rapid.

The question may arise in the minds of some as to what would happen if all variable condensers shown at the left of each of the electron relays were connected together mechanically and moved together simultaneously in the manner just described for the case of the $R$ resistances. Here, in this case, instead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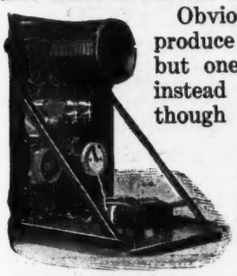
of causing a change from violin to other music, a far-reaching shift in pitch of the whole instrument results. In consequence the effect greatly resembles that produced by sliding one's fingers along the strings of a ukelele at the same time it is being played. If one happens to be producing whistle- or calliope-like music at the moment, he will get an effect resembling a steam siren starting up, or a mocking-bird fire whistle. There is no end to the results that may be secured by shifting the condenser levers and the resistance levers in various ways.



Rear of De Forest's socket radiophone

Obviously one can produce this music with but one electron relay instead of several, though perhaps with not so great facility. To get a complete scale or octave from one relay it is necessary to install seven or eight *fixed* condensers at the place marked "tune for pitch" in the drawing. These condensers should be in parallel but with individual keys intervening, so that any one of them can be cut in at will, giving the corresponding pitch. You finger *these* keys to produce the melodies desired. Similar keys arranged on parallel resistances at $R_1$ will alter the character of the music resulting—whether it is to resemble a flute, violin, and so on.

Just because the foregoing circuits have produced results there is no reason why experimenting will not lead to added results. Investigators should do much in this line.—L. E. DARLING.

## Cardboard Cylinders Are Worth Saving

IN winding inductance coils for wireless use, the amateur is usually at a loss to find suitable cardboard tubes. These should be saved, so that a number will be on hand when needed. Ordinary dry-cell covers make good tubes. Being 2½ in. in diameter, they serve almost as well as purchased tubes.

Mailing-tubes are not to be neglected. A simple tuning-coil can be made by winding a mailing-tube with a single layer of No. 24 double-cotton-covered wire, and putting it between two blocks. One or two sliders, as desired, should be arranged to run over this coil. With a winding of ten inches on one of these tubes, with an average aerial, one can tune to approximately 1,000 meters, which is sufficient to get many of the commercial stations and all amateur stations. When using a double-slider coil of this kind with a standard vacuum tube, very good reception often results.—PHILIP A. WALL.

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## Radio Can Reach Even Submarines

"THE coil fell in the water, and for an instant I still heard signals." In this simple manner does J. A. Willoughby, a young investigator in the Bureau of Standards, Washington, D. C., record the making of a discovery which practically revolutionized all submarine radio during the war. He found out that an underseas boat need

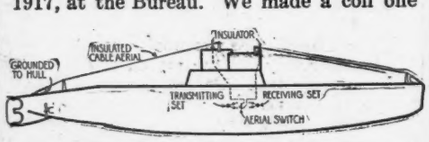
The unobtrusive aerial rose but five or six feet above the hull

not come to the surface and raise an aerial in order to receive radio messages—a loop aerial under water will do it. Says Mr. Willoughby:

Dr. Stratton, Director of the Bureau of Standards, and I were at Arundel, on Potomac Bay, receiving signals on a four-foot coil. Then it tumbled in the water—and I still heard the signals. Of course, when the salt water soaked through the insulation, the signal died out.

I remembered that happening. Later, in working around the laboratory with direction-finders, I was able to detect neighboring street-cars (by motor or trolley lead-in brush discharge) a mile away, and to follow them as they passed the Bureau. I could also receive signals in the sub-basement of the east building. When the Germans were sinking so many ships off our coast, I at once began to think about a submarine detector that would give the exact location of the submarine. Then by using a depth-bomb we could put the plunderers out of business.

Our first test was made in November, 1917, at the Bureau. We made a coil one




The submarine hull itself helped the aerial form a loop

foot in diameter with 20 turns, paraffined to make it water-proof. With a French four-step amplifier spark signals were received from the Arlington Radio Station with the coil submerged about five feet in a large tank of fresh water. The distance was ten miles; wave-length, 2,500 meters.


# AGENTS

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**Sells in Every Home**

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| And up to | 40.00 |

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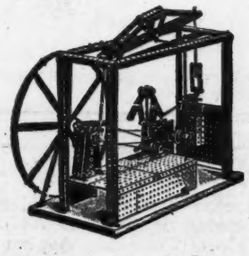

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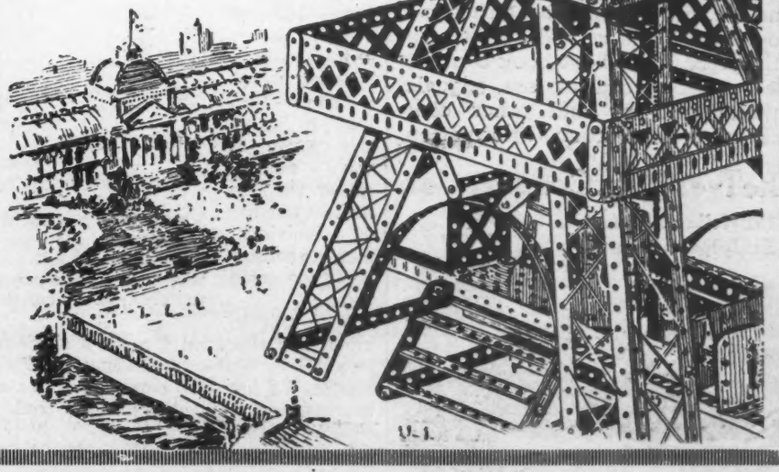

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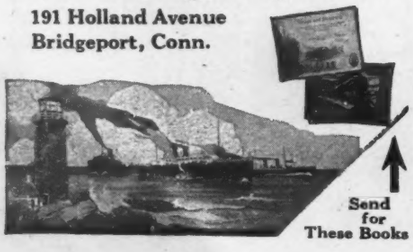


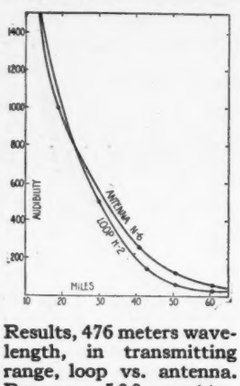
Send for These Books


Our next test was with a two-foot coil of 20 turns, water-proofed. It was submerged in the tidal basin of the Potomac river. Signals were received from Arlington

Another view of the submarine and its aerial, showing the simple construction

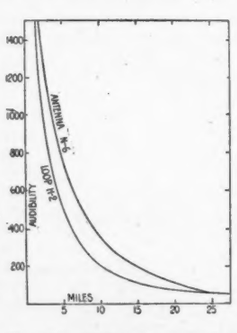
when the coil was on the bottom of the river—which was about fifteen feet.

About December 20th, a 29-turn circular loop, ten feet in diameter and encased in a rubber tube, was made. It had insulated leads 30 feet long. The loop was submerged until its lower side rested on the bottom, making the top side about six or eight feet below the surface. Signals were received from (YN) Lyon, France; (OUI) Nauen, Germany; and (NPL) San Diego, Cal. The loop had very sharp directional characteristics, both on the surface and submerged.




Results, 476 meters wavelength, in transmitting range, loop vs. antenna. Power, 500 watts. Area N-6, 2,452 sq. ft.; of H-2, 791

In March, 1918, while looking over the apparatus of the French Commission, I saw a tuner especially designed for loop reception. At this time loops were designed to work on a given wave-length. This made it impossible to work below the fundamental of the loop. It occurred to me that with this tuner — which had a range of wave-lengths of from 100 to 16,000 meters —it would be practical to use a single-turn loop to cover this range of wave-lengths, rather than to make a number of individual loops to accomplish the same thing.




Results, 850 meters; other conditions same as in curves above at left. These show loop performance is uniformly good at all times

With this in mind, one afternoon I made a single-turn loop, 150 by 60 feet, and, using the French tuner and a four-step amplifier, I was able to cover any wave-length that could be covered by an antenna.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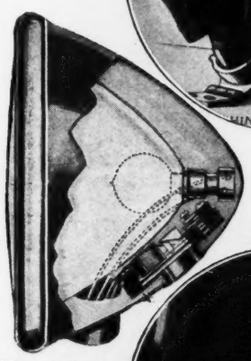

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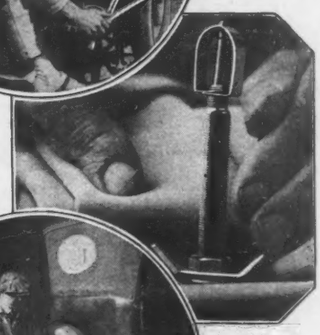

*Tire Valve Exhaust*

*New Tank Filling Machine*

# 400 Ideas for Motorists

## Here Are 20 of the 400 Practical Ideas


| | |
|---|---|
| Spark Plug That Can't Break | 4 |
| Muffler That Can't Jar Loose | 8 |
| New Tire Pump Without Valves | 8 |
| Controlling Speed Automatically | 13 |
| New Universal Truck Body | 16 |
| Moisten Air for the Engine | 27 |
| Keeping Chills from Engine | 29 |
| Little Things for Economy | 34 |
| A Mechanical Cranker | 47 |
| Utilizing 2nd Hand Magneto | 64 |
| Tinfoil as Substitute Fuse | 65 |
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| Avoiding Engine Trouble | 80 |
| Use for Dash Lamp on Ford | 82 |
| New Ford Timer | 83 |
| Clear Windshield in Wet Weather | 89 |


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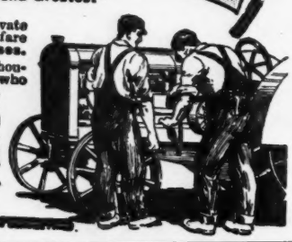


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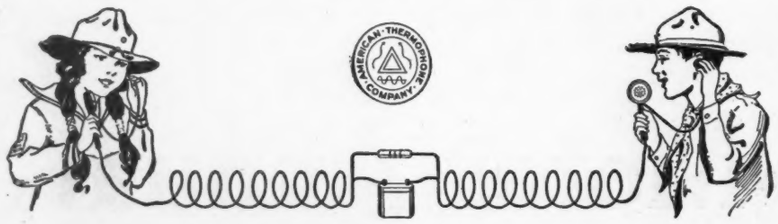


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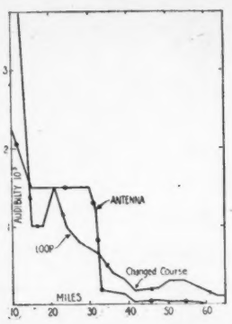
P. D. Lowell, also of the Bureau, assisted. Together they made practical tests of the new form of aerial on actual submarines at the Navy's submarine base, New London, Conn. Says Mr. Willoughby further:

June 11, 1918, while at sea, the insulation on the new type of loop was found to be defective and the bare wire exposed to the salt water. Upon submerging, however, we found, much to our surprise, that the loop worked equally as well as when it was absolutely insulated from the water. This led us to believe the hull of the boat could be used for one side of the loop. We therefore cut out the lower side of the loop, and grounded the extreme ends of what was left to the boat, making final loop.




Results, 476 meters, loop vs. antenna on the same submarine, the H-2. Power, 500 watts. Transmitting results were almost as good as the receiving

This form proved to be by far the best tested. Nauen, Germany, signals were received when the loop was submerged eight or nine feet under water. The American Navy now uses Messrs. Willoughby and Lowell's discoveries far and wide in its submarine radio. The new form of aerial is a great improvement over old types. In so simple a manner as this did two inventive young Americans get in a blow on German submarine warfare.

The single-turn loop, one half of which is any metallic object, works anywhere—on land and in the air as well as in the water on submarines, according to Mr. Willoughby. The "metallic object" may be the metal parts of a house or of any other fixed or movable structure. The loop may be used in or on the ground.

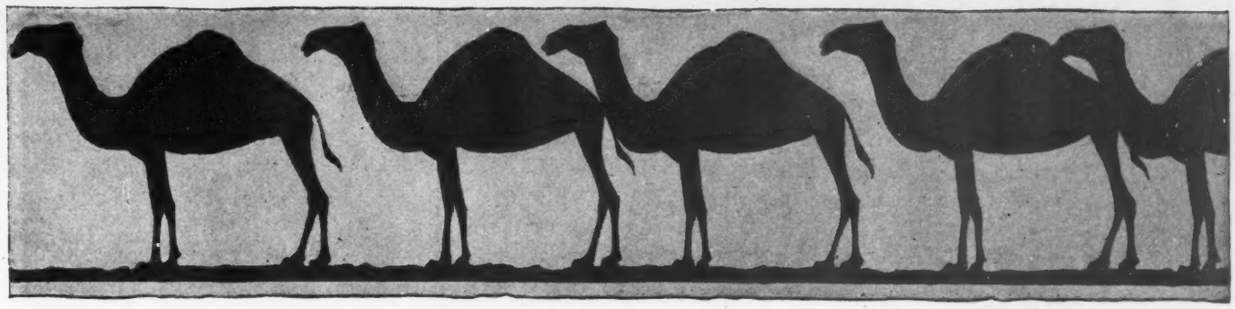
With submarines running full speed in heavy sea messages have been *transmitted* 50 miles with this form of grounded loop; it was estimated that 150 miles could be reached.

The publications of the Bureau of Standards on radio subjects, written by some of the best authorities in the country, are very helpful for amateurs. Following are two of the most general and easily understood of the publications:

Principles Underlying Radio Communication. Textbook of 355 pages. Published as Signal Corps pamphlet No. 40. Price 55 cents. Army Signal Corps men were trained from this book during the war.

Radio Instruments and Measurements. More advanced than the other; gives complete data of many kinds. Price furnished by Superintendent of Documents.

For either book address the Superintendent of Documents, Washington, D. C. We shall publish a complete list of Bureau of Standards publications shortly.



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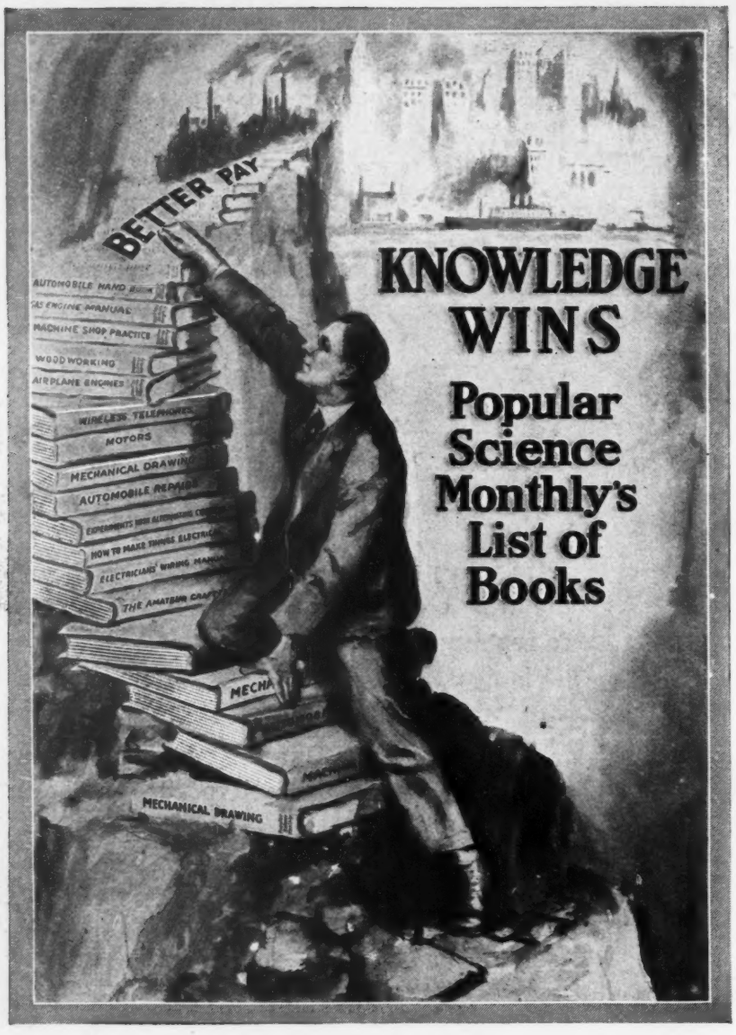


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## Government Requirements in Station Operation

THE Secretary of the Navy has removed all restrictions on amateurs and amateur radio stations. In the wording of the Secretary's order, the lifting of the ban . . . .

applies to amateur stations, technical and experimental stations at schools and colleges, and to all other stations except those used for the purpose of transmitting or receiving commercial traffic of any character, including the business of the owners of the stations. The restrictions on stations handling commercial traffic will remain in effect until the President proclaims that a state of peace exists.

Attention is invited to the fact that all licenses for transmitting stations have expired, and that it will be necessary for the amateurs to apply to the Commissioner of Navigation, Department of Commerce, for new licenses.

Here is the notice issued by the Department of Commerce:

Before operating transmitting stations it is necessary to take an examination and secure an operator's license—also to have on file with the district radio inspector a formal application for a station license. If there is likely to be delay in issuing your station license, the radio inspector can assign radio call letters when the application is received.

All amateurs should be familiar with the Radio Laws and Regulations. This publication can be procured from the Superintendent of Documents, Washington, D. C. Price, 15 cents.

All transmitting stations should be inductively coupled. Stations having what is known as a plain aerial, or the spark gap directly in the antenna circuit, will not be licensed where they do not comply with Regulations 3 and 4 of the act of August 13, 1912.

The List of Radio Stations of the United States, edition of June 15, 1919, does not contain amateur stations. This publication can be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 10 cents. A list of amateur stations may be published about the first of January, 1920.

Any additional information required by amateurs may be obtained from the radio inspectors of their districts. These should be addressed simply as "Radio Inspector," and at whichever of the following addresses is nearest the amateur:

Customhouse, Boston, Mass.; Customhouse, New York, N. Y.; Customhouse, Baltimore, Md.; Customhouse, New Orleans, La.; Customhouse, San Francisco, Calif.; Federal Building, Detroit, Mich.; Federal Building, Chicago, Ill.; 205 Citizens Bank Building, Norfolk, Va.; 2301 L. C. Smith Building, Seattle, Wash.

The territory covered by each district is shown on page 68 of the Radio Laws and Regulations. Amateurs in the Fourth District should address their communications to the Radio Inspector, Customhouse, Baltimore, Md.

**What do you know that is new and interesting in radio? Send us your ideas, with pictures—plenty of pictures—and all the diagrams you can think of that will help to make the idea entirely clear. We pay for acceptable contributions.**

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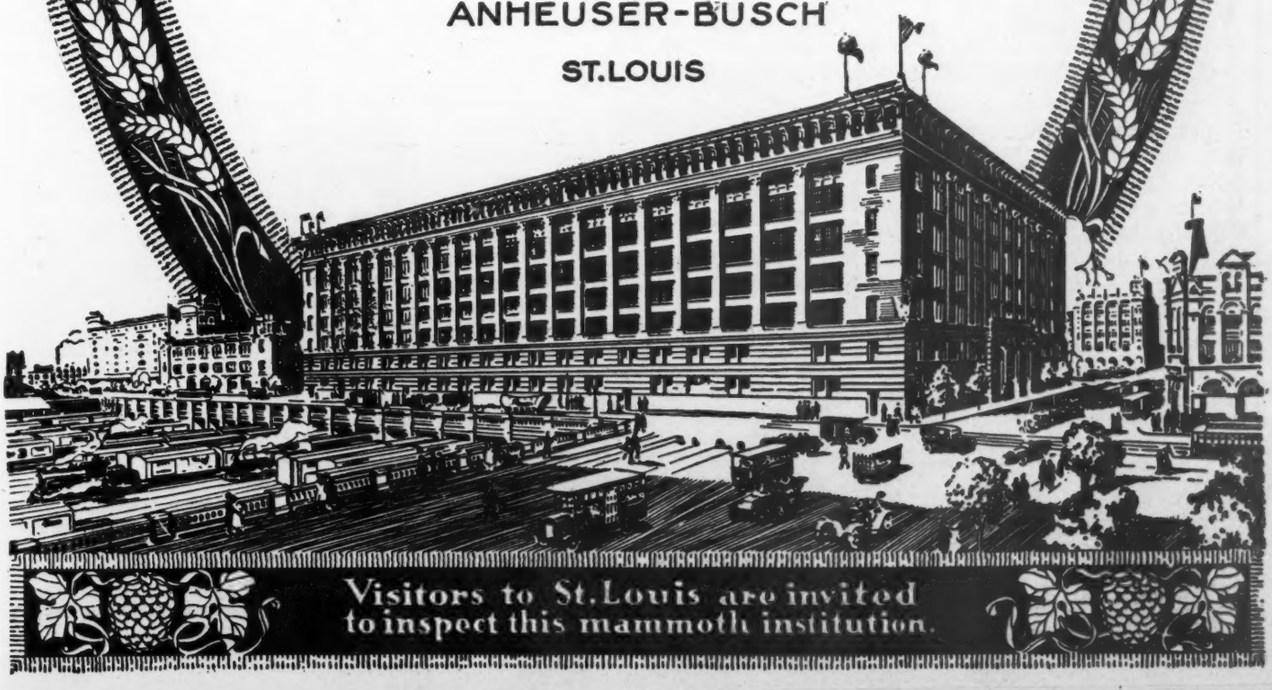
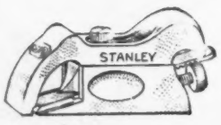
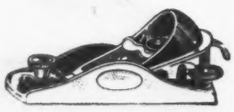
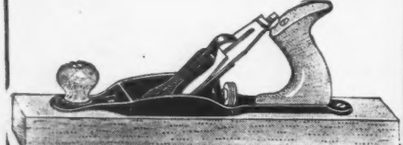


Visitors to St. Louis are invited to inspect this mammoth institution.

# Stanley Tools





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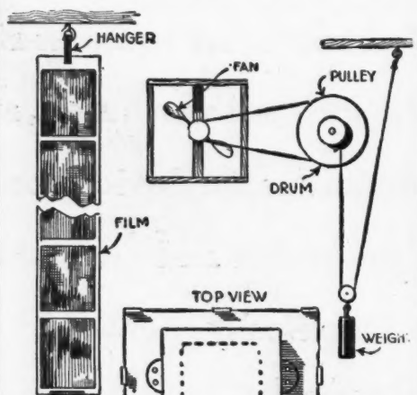
## A Cheap and Efficient Film-Drying Closet

FOR the amateur photographer who wishes to dry a film in a hurry, or the professional finisher who has large batches of film that have to be dried and printed in specified periods, the film-drying closet here described will be found a great time-saver.

Still heat is a poor drying medium, being apt to overheat and cause the emulsion to run. On the other hand, films dry extremely slowly in quiet damp air. A happy combination is found in this closet, which furnishes a slightly warmed air, which circulates in and about the films and is finally excluded. With proper manipulation, films can be thoroughly dried in half an hour.

First build the sides and back of the closet of matched boards, fitting them closely together to make the closet as dust-proof as possible. The closet is simply a long, narrow box, upended, with one side open. The sides are




**This combination furnishes slightly warmed air which dries the films quickly and safely**

5½ ft. high by 1½ in. deep. The back is the same height and 2 ft. wide. That also makes the front 2 ft. wide. This is fitted with doors, as shown, reaching down 4 ft. Line the abutting edges and the edges next to the jam with felt, to keep out the dust. A header across the front of the closet is inserted to make contact with the bottom of the doors.

The 1½-ft. space below the doors is used to house the heating apparatus. The writer has used a small one-burner oil-stove with good results, although gas can be used if preferred. Two baffle-plates of sheet zinc should be placed just above the heater to break the direct heat. They also serve to distribute and diffuse the warmed air to all corners of the closet.

Close this compartment with a tightly fitting door, hinged vertically. The front should be furnished with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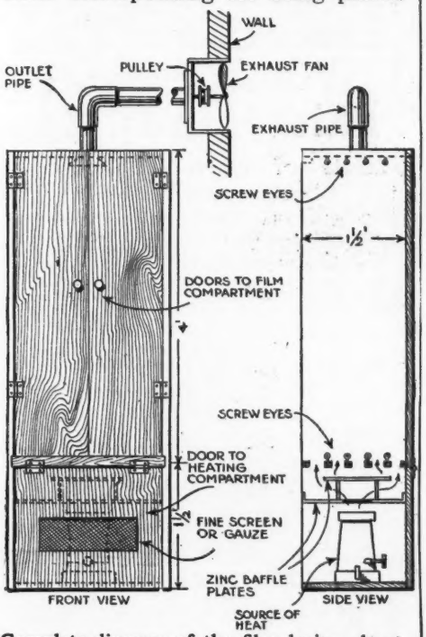
a gauze-covered opening to admit air but exclude dust. For this reason the gauze should be very fine.

Arrange several rows of screw-eyes across the width of the closet, placing the screw-eyes about 5 in. apart, and the rows about the same, so that the wet films will not twist when hanging, and stick together. One set of screw-eyes is placed in the top of closet, the other corresponding set being placed




**Complete diagram of the film-drying closet. The opening is covered with dust-proof gauze**

in horizontal strips across the closet four feet below, opposite the bottom of the doors.

The outlet pipe for carrying off the exhaust air can be made of common gutter-pipe inserted through the top of the closet and leading out through the wall. Where there is not sufficient draft to carry off this wet air, a fan can be arranged, as illustrated, that will do the trick nicely. Make an air-tight jointed box about a foot square, into which the pipe fits. A metal fan is turned by either a small electric motor or by the simple arrangement of the weight and pulley wheel shown. The writer, who has not access to electricity, has obtained good results with the latter.

Simply arrange the pulley and drum so the belt can be belted to the propeller pulley through two small holes in the box. By winding the weight up with a crank it will slowly drop if not too heavy, and revolve the fan rapidly. Be sure the fan revolves in the right direction to carry off the air instead of forcing it in.

Fasten the films in the closet at both ends, so they will not swing—the elastic band arrangement shown makes a simple but effective method. Then start a gentle heat, and, if there is no natural draft, start the fan. Close the doors tightly, and in the course of half an hour or so your films will be ready to print.—L. B. Robbins.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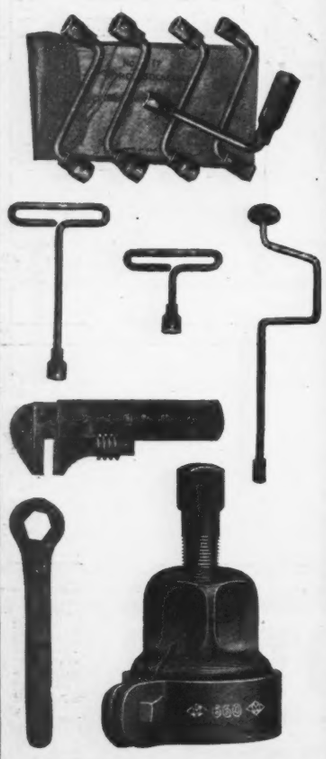

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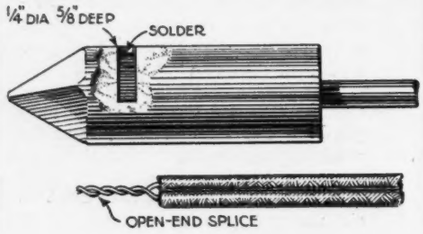
## Improving the Soldering-Iron for Open-End Splicing

A USEFUL improvement that can be made on any soldering iron is shown in the accompanying illustration.

A hole about $\frac{1}{4}$ in. in diameter and $\frac{5}{8}$ in. deep is drilled in the side of the iron and filled with solder. It is a time-saver for rapidly soldering twisted-wire joints. In this particular




**Soldering on open-end wires is made more easy if a hole is drilled in the tip of the iron**

case, splices of the open-end variety may be made with much better results than by using the tip of the iron for soldering.

The iron is heated until the solder in the hole melts, and then the splice, covered with soldering paste or acid, is dipped into it.

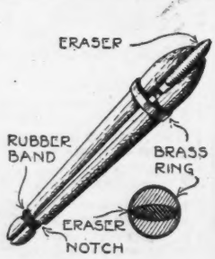
This makes a well soldered and substantial joint in a remarkably short time.—PETER J. M. CLUTE.

## An Easily Made Holder for a Short Eraser

WHEN erasing large drawings the fingers often become cramped, especially if one is using a short or small eraser.

A holder, which you can make, will allow the user to get a firm grip upon the erasing material. This holder will also take small and otherwise assorted pieces that would otherwise be thrown away.

Whittle out two pieces of wood somewhat after the tines of a clothespin. Place them together and at one end cut a notch. The opposite ends should be slightly hollowed out and notched to gain a grip upon the eraser. They should fit together, the notched ends being smaller than the others.




**When erasers wear down, you need a holder: here it is**

Fit a brass ring around them as shown in the illustration, and bind the notched ends together with an elastic band. Fit the eraser in the jaws and then slide the ring along until it grips the eraser firmly and tightly between them.—L. B. ROBBINS.

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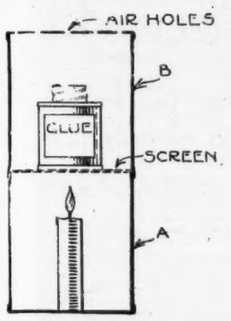
**Gilson Slide Rule Co., Niles, Mich.**

## A Good Way to Keep Glue Warm

IT is very inconvenient when you are using the glue-pot, suddenly to find that the glue has grown cold and congealed.

By making and using a glue-warmer like the one shown in the illustration, you can eliminate this trouble.




An easily made glue-warmer that produces good results

Two ordinary tin cans, a piece of wire netting, and a candle are the only materials necessary.

Set the candle in the lower can, the wire netting between the cans, the glue pot on top of this, and the other can over the whole thing to retain the heat.—J. H. MOORE.

## The Barrel Transformed Into a Wagon-Seat

A CALIFORNIA rancher devised a wagon seat from one end of a kerosene barrel, which is placed on the projecting ends of the 2 by 4 in.

Here is the original bucket-seat. It is made from one end of a kerosene barrel and fills the bill nicely

strips of wood that form the detachable floor of his dirt-wagon.

The barrel is sawed off just below the center, while a second cut is made just above the third hoop, and a third cut just above the first hoop, leaving the bottom intact. The hoops are then drilled over each stave and a nail driven in and riveted or clinched inside. The second and third hoops are cut, the ends reaching the edge of the staves.

The top is padded and covered with canvas, which is bound around with a strong tape. The whole makes an upholstered easy seat, that is readily placed on and off the wagon. The uses to which this seat can be put are innumerable, and it relieves one of that tired feeling which is often encouraged by the common type of board seat.—CHARLES WAGNER.


SARGENT
LOCKS AND HARDWARE

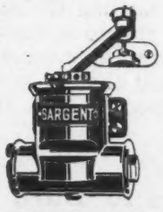
**Look ahead—plan to**

***put your own key in your own front door***

And don't let your choice of building materials stop with the selection of wood and stone. Choose your hardware. Select locks and hardware which will be in harmony with your home.

In Sargent Hardware, protection and attractiveness are combined with durability. Your architect knows this and will vouch for the solid quality and superb finish of all Sargent products.

Select with him, from the Sargent Book of Designs, the particular design which is in keeping with your home. There you will find many tasteful patterns which were created by Sargent designers to harmonize with the highest architectural and decorative standards. We will send you a copy on request.




**Sargent Door Closers**

In every home there are doors that should be kept closed—back-stair door, storm door, cellar door, lavatory or closet door. Sargent Door Closers add to the quiet and dignity of the home—no doors ajar, no slamming and banging.

**SARGENT & COMPANY, Hardware Manufacturers**
**50 Water Street, New Haven, Conn.**



***"I Cut 27 Cords of Wood a Day"***

**—says Noah Digge, of Jacksonville, North Carolina, "with my Ottawa Log Saw under unfavorable conditions, and in 52 hours I sold and delivered $75 worth."**

You, too can make big profits with the Ottawa Engine Log Saw. It is always on the job, and saws from 25 to 40 cords a day. Pays for itself in short time. Takes the backache and worry out of wood cutting. One man does the work of ten. No stopping the engine and no lifting, prying, backing or twisting to set from cut to cut. Wheels like a wheelbarrow from log to log—easily moved from cut to cut on log.

**OTTAWA LOG SAW**

*"Now you can saw down trees and cut up logs by power."* Geo. E. Long

Direct gear to drive saw—no chains to tighten, no keys and no set screws. Automatic friction clutch protects saw, allowing slippage under any pinch. 4-Cycle Frost Proof engine, Oscillating Magneto Ignition. When not sawing demount saw equipment, by pulling one pin, and use engine for all kinds of other work.

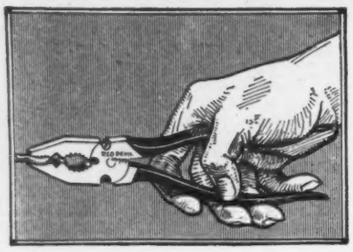
***Tree Cutting Equipment Full Information FREE***

Write us, now, for full information on this log saw, and on our fast cutting equipment for sawing down trees. Low prices, now, on both outfits.

**10 Year Guarantee**
**30 Days' Trial**

Beware of Imitations

**OTTAWA MFG. CO.** 1805 Wood St. Ottawa, Kansas.



## They Give You Fingers of Steel

The handy man will be handier with a pair of "Red Devil" Pliers. The mechanic will find them indispensable.

For amateur use in the household they can be applied in hundreds of ways.

For the professional no other single tool can be used more effectively.

Made in over 100 styles. There are "Red Devil" Pliers for general and for special use.

All "Red Devil" hand tool are honestly made, made to wear. They will last a lifetime.

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**Electrician's Tools**
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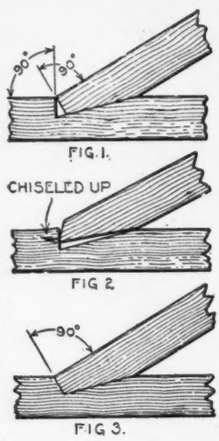
*Try "Red Devil" Corrugated Lock Washers — six point contact, hold fast.*


## Mortising a Rafter to Gain Strength

THERE is a right and a wrong way to do everything. A rafter, for instance, can be mortised into a timber in such a way that it will weaken the structure instead of strengthening it.

In Fig. 1 the mortise is shown cut at right angles to the surface of the timber. This is bad, because if the rafter is disturbed from its intended position in the mortise its end is likely to bear heavily against the short end of the timber, and with the grain, thus tending to shear it off. The rafter also has been squared off with its straight edge, which causes it to bear entirely at the top edge of the timber.




**The right and wrong way to mortise a rafter and the reason why**

In Fig. 2 you see the same mortise, but the end of the rafter is shown cut at an obtuse angle, which allows it to act as a chisel. In this way it is liable to pry up the timber end if forced out of line.

Fig. 3 illustrates the best method, because the end of the rafter, which is cut at 90 degrees with its upper edge, butts firmly against the end of the mortise cut at the necessary angle. By this method the shearing force is reduced and so is the chiseling force. The downward pressure is more evenly distributed than in either of the former methods.— L. B. ROBBINS.

## It Pays to Burn Headlights in the Daytime

NEXT time you see an automobilist driving along the street in the middle of the day with his headlights turned on, do not yell at him because you think him either stupid or careless. Perhaps he knows what he is doing and is trying to increase the life of his storage battery.

There is as much danger in an overcharged storage battery as there is in one allowed to run down. On long trips during the daylight hours, when the car is operated at speeds of twenty-five miles an hour and over, the battery is liable to be overcharged. When this occurs, the battery overheats. Automatic cutouts sometimes do not work properly or quickly enough, and burning the lights during a portion of long trips is an added precaution which may save the motorist the price of a new battery.


## BATTERY CHARGING PAYS BIG PROFITS

### Winter Brings Biggest Profits

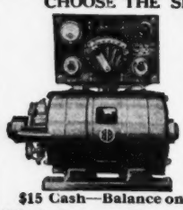
You can have from $100 to $350 profit monthly from charging batteries, in connection with your present business, by establishing a battery recharging station. Now is the time to get into this work. Get those big profits.

You can readily handle a battery charging business, as no special electrical or mechanical knowledge is required to install or operate.

**An HB Battery Charger for Every Size Business**

All HB Chargers are sturdy, dependable and absolutely reliable. Practically wearproof. Nothing to burn out, no expensive renewals or repairs. No attention, except occasional oiling. Uses power from your lighting lines. Big, quick profits, easily made.

**CHOOSE THE SIZE YOU NEED**

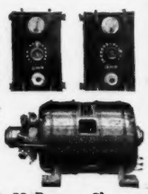


**HB 500-Watt Charger**

Recharges 1 to 8 6-volt batteries or their equivalent at a time. Furnished complete with clear, black, electrical, slate switchboard, with mountings of ammeter, field rheostat, voltage lamp, two controlling switches. A big money-maker for a small battery business.

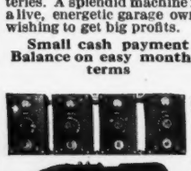
**$15 Cash—Balance on easy monthly terms**

**HB 16-Battery Charger**



Recharges 1 to 16 6-volt batteries at once or their equivalent in 12 or 24-volt batteries. Furnished complete with 2 independent charging panels, each with a capacity of 8 batteries. A splendid machine for a live, energetic garage owner wishing to get big profits.

**Small cash payment**
**Balance on easy monthly terms**



**HB 32-Battery Charger**

Recharges 1 to 32 6-volt batteries or equivalent at a time. Four separate charging lines, each capable of charging up to 8 batteries. Ideal equipment for big garage or battery service station. Will make as high as $250 to $450 a month clear profit.

**Small cash payment**
**Balance on easy monthly terms**

**Sold on Trial Under HB Absolute Money-Back Guarantee**

All HB Equipment is sold under our absolute guarantee of complete satisfaction. You run no risks. If not satisfied after using any HB Equipment 10 days, you may return it and receive all you paid us. The HB monthly payment plan is an additional guarantee.

**Select the Charger You Need. Check the Coupon Below.**

Mark on this coupon this HB Charger you are interested in. Tear it out and mail TODAY. Be the first in your town to have an HB Charger. Don't delay. Act now.

**TEAR OFF HERE**

**HOBART BROS. CO., Box S127, TROY, OHIO**

Send me information about the HB equipment checked below, and tell me about the HB Money-Back Guarantee and Trial plan:

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.....HB 16-Battery Charger
.....HB 32-Battery Charger
.....HB Belted Charger (Used where electric current is not available)

*Your Name*.....

*Address*.....*State*.....

## "Saws 25 Cords In 6¼ Hours"

**That's what Ed. Davis, an Iowa wood sawyer says he did with a WITTE 6 h. p. Saw-Rig. Another claims 40 loads of pole wood in 3 hours and 20 minutes with a 6 h. p. Hundreds of WITTE Saw-Rig owners have made similar records, and are coining money.**

**You Can Do As Well**

Any hustler can make big money with the WITTE. When not sawing you can operate other machinery. It's the one all-purpose outfit for farmers and men who make sawing a business. Prices are favorable right now. As an illustration, you can get a 2 h. p. WITTE Stationary Engine on skids, complete catalog equipment, now, for $44.95, cash with order. All other sizes, 2 to 30 h. p., at low prices. Lifetime guarantee. Big catalog of Engines and Saw outfits FREE. Write for it TO-DAY.

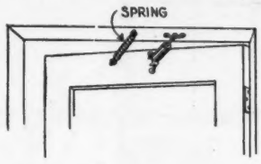
**WITTE ENGINE WORKS**

KANSAS CITY, MO. 2221 Oakland Ave.
PITTSBURGH, PA. 2221 Empire Bldg.

## How to Make a Door-Check from a Bicycle Pump

WITH only a little transformation a small hand bicycle pump may be pressed into service as a door-check.

A thin, narrow strip of strap-iron or brass is soldered to the bottom of the pump, and bent as shown in the illustration. This is then punched for a length of ten-gage wire.

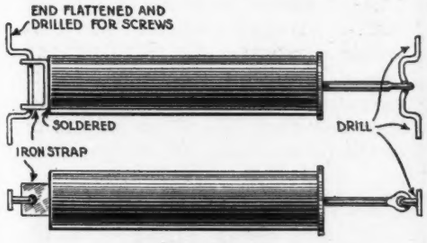



The spring at the top of the door helps the pump to do its work properly

The threaded connection at the air outlet is removed, and the end flattened, and the cracks filled with solder to strengthen it. This is also punched.

The wire is then run through the holes provided, and bent, after which the ends are flattened and bored for a small wood-screw. The wire running through the flattened end of the pipe is bent forward slightly to prevent its working down.

This device works best when a spring is used on the door, and with this arrangement a much stiffer spring




How the pump is transformed into a door check is seen by the illustration

can be used, and at the same time, with the check, prevent the door from slamming.

This check works well on windy days, since it prevents any rapid opening or shutting of the door. The plunger of the pump should be moderately dry, in order to allow some leakage of air in the chamber.—DALE VAN HORN.

## A Spray Irrigation Post for Thirsty Crops

THE growth of spray irrigation in the past ten years has been phenomenal. Hence, any device that will aid a system that has developed from the lawn-sprinkler of the city dweller to overhead irrigation machinery for supplying water to entire fields of growing crops merits consideration. The accompanying illustration shows an anchorage for suspending overhead spray-nozzle lines. An overhead spray-nozzle line can be supported by telephone-poles from 8 to 10 in. at the base and from 6 to 8 in. at the top. Wooden posts should be painted with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Tests, Not Guesses!

guide the making of Simonds Saw Steel, whether employed in fabricating our many types of saws for metal or wood cutting—or for the hardened, tempered flat plates we furnish of this same steel, ground to the specifications of other manufacturers.

This super-care exercised in producing Simonds Saw Steel insures a quality that is edge-holding, wear-resisting and uniform.

Your inquiries are invited for Saws or for Steel Plates.

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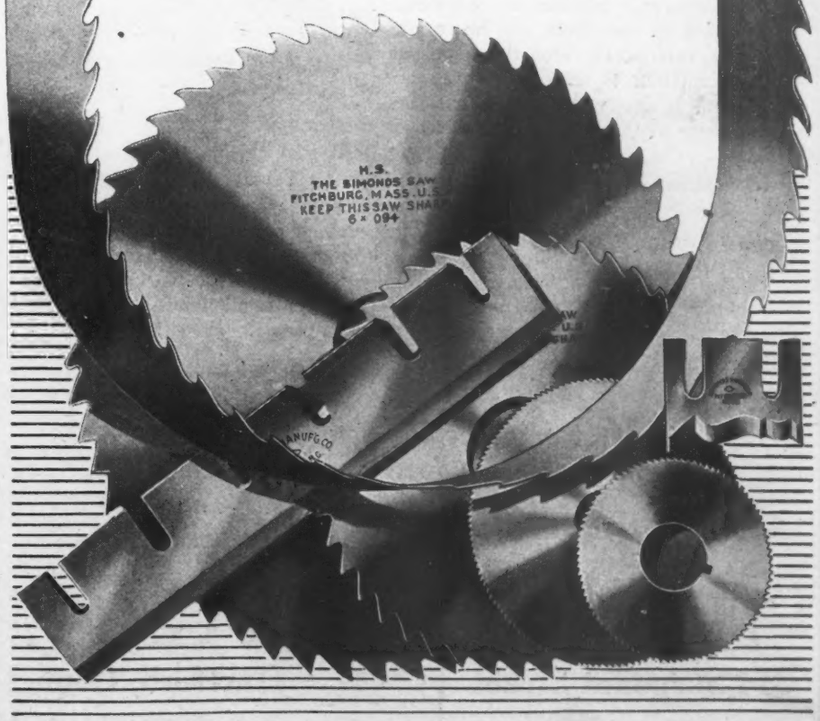


# Getting Closer to Capacity

As things are in industry to-day, the *capacity* of a machine is not so important as getting an output somewhere near that capacity.

Veeder Counters show the operator what his machine can produce by recording what it *does* produce — and what rate-of-work is *standard.*

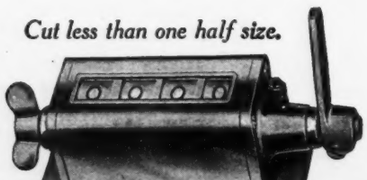
You easily bring-up closer to capacity when you equip with

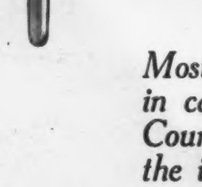
Veeder
COUNTERS

—**because** you know what each machine is doing in time to make it do *more*—if the standard for the job calls for more.

The Revolution Set-Back Counter records the output of any machine where a shaft revolution indicates an operation. Sets back to zero from any figure by turning knob once around. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $9.00 (subject to discount).

*Cut less than one half size.*





The Number 14 Rachet Counter at left registers one for each throw of the lever, recording number of machine operations. Supplied with outside stops which regulate the throw of the lever, and having return spring action which automatically returns the lever into position for the next count. The lever is adjustable, allowing the counter to be used at any angle. Price, $2.25.

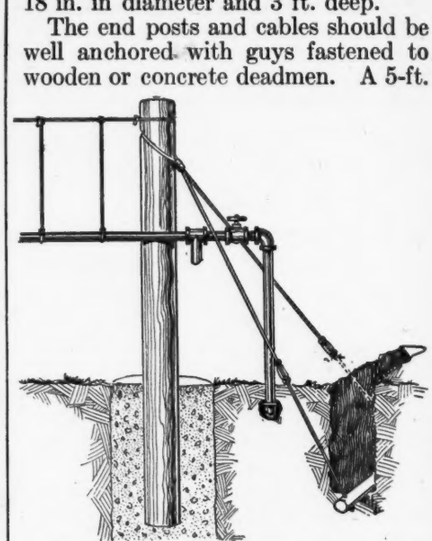
*Cut nearly full size.*

*Most any machine you're interested in can be equipped with a Veeder Counter; the Veeder booklet shows the instruments. Copy on request.*

**THE VEEDER MFG. CO.**
**44 Sargeant Street - Hartford, Conn.**


tar or treated with creosote. The posts should be elevated higher than the line. The bases of the posts should be set in beds of concrete about 18 in. in diameter and 3 ft. deep.

The end posts and cables should be well anchored with guys fastened to wooden or concrete deadmen. A 5-ft.



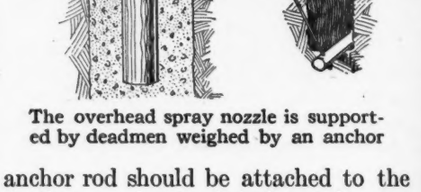
**The overhead spray nozzle is supported by deadmen weighed by an anchor**

anchor rod should be attached to the deadman and extended above the surface, with the eye where a turnbuckle and a guy-wire can be attached. Single guys are used where the tops of the end posts of several lines can be connected with a guy-wire perpendicular to the nozzle lines; otherwise double guys are used. The distance between the deadmen and the post should be equal to at least one third the height of the base of the post.—S. R. WINTERS.

## Covering Steam-Pipes to Save Heat

COVERING steam-pipes with a specially prepared coating or sleeve to prevent the waste of heat where it is not wanted is a precaution observed by many plumbers.

The method here illustrated was adopted in a case where a steam-pipe was run in the open to heat a shed for temporary work. While, in



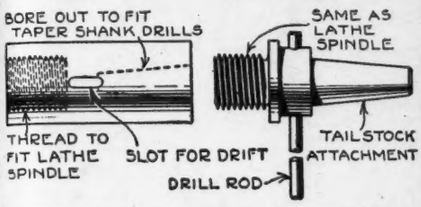

**Old newspapers wrapped around the steam-pipes will retain heat that is usually wasted**

this case, it was only a makeshift, it might be neatly done and used permanently. Paper may be used inside and cloth outside where weather conditions would not permit the use of paper.

First the pipe is wrapped with an old rope, small in size, in spiral form; then old newspapers are wrapped on the rope and loosely tied with twine or a cord.—CHARLES R. FISHER.

## Attachment for Holding Taper Shank-Drills in a Lathe

THE illustration shows a steel sleeve bored and internally threaded to fit the spindle of a lathe at one end and the other end bored out to take taper shank-drills. A slot is cut for the insertion of a drift the same


BORE OUT TO FIT TAPER SHANK DRILLS
SAME AS LATHE SPINDLE
THREAD TO FIT LATHE SPINDLE
SLOT FOR DRIFT
TAIL STOCK ATTACHMENT
DRILL ROD

Drills held in this manner cannot slip aff and break. The live spindle will now hold taper shank-drills

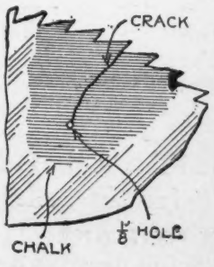
as in a drill-press sleeve. This allows the use of taper shank-drills on a live spindle of the lathe.

The sleeve may also be used on the tailstock by being screwed into the attachment shown at the right. The outer end of this is threaded the same as the lathe spindle, and the other end tapered to fit the tailstock. The shoulder is drilled for a piece of drill-rod, which rests against the lathe-bed and keeps the attachment from turning. Drills held in the tailstock in this way are in no danger of slipping off and being broken, as is the case when they must rest against a dead center.—H. H. BARKER.

## A Circular Saw Must Not Be Neglected

VERY often a circular saw will become cracked, and if it is not taken care of it is apt to break while in use. Such neglect has caused many a fatal accident.

When a saw is found to be cracked it should be repaired immediately. First find the extreme end of the crack by the following method: place several drops of oil on the saw near the crack, thoroughly rub it around, and wipe off all the oil that is on the surface. Now, with a stick of white or light-colored chalk, coat the surface of the saw. The oil will come out of the crack and discolor the chalk, showing the extreme end of the crack, which is otherwise often invisible.




Never neglect a cracked circular saw. It's bad business for one using it

At the extreme end of the crack make a mark with a prick-punch, and with an ⅛-in. drill bore a hole through the saw. The hole in the steel prevents the crack from going farther into the metal, and the saw can be used with perfect confidence that it will not break.—HAROLD F. NEFF.

Brown & Sharpe Tool Service
Service that is reflected in work accomplished.
Service that is evident through length of time.
Service that has satisfied three generations.
Brown & Sharpe Mfg. Co.
PROVIDENCE, R. I.

# DISSTON
## SAWS AND TOOLS

## The Disston Family of Quality Tools

Here are some of them. Each tool of our big Disston family is of the same quality that has made Disston Saws the world's standard for almost eighty years.

Six Hundred of our 3,600 workmen are engaged in the making of Steel in our own mill, all within the walls surrounding our 61-acre plant.

Each kind of tool is made of a special mix of steel, peculiarly adapted to meet the requirement of that particular tool, which, together with scientific hardening and tempering, gives greatest efficiency.

**(1) Disston Screw Driver.** Blades of special grade of steel found to give greatest durability. Points well shaped and tough. Properly fitted handles of hardwood, comfortable to the hand.

**(2) Disston Marking and Mortise Gauges.** Varieties ranging from those made of plain hardwood to more expensive box and rosewoods, with plated cutting heads and stem.

**(3) Disston Back Saws.** Blades of Crucible Saw Steel evenly tempered and accurately ground to run with minimum amount of set. Filed for smooth cutting.

**(4) Disston Taper Files.** These are the files for long life on Disston Saws. Teeth are properly formed and thoroughly hardened. Files are subjected to actual filing test before passing inspection at the factory.

**(5) Disston Plastering Trowel.** Our experience and reputation as makers of high grade plastering trowels closely rival our position as producers of hand saws. Tight rivets, thin blades, mountings and handles so placed as to insure proper balance and ease in working.

**(6) Disston Hack Saw Frames.** All styles. Model shows extension frame. Very strong and rigid. Design of handle affords easy operation and control.

**(7) Disston Hand Saws.** The standard the world over. We are the oldest and largest manufacturers of hand saws in America.

**(8) Disston Brick Trowels.** Are made with careful consideration given to balance, lift and weight. Obtained by up-to-date forging and grinding facilities. Temper second to none.

**(9) Disston Saw Sets.** Made on the proper principles. Have a double lever. One plunger tightly clamps saw blade on the anvil, while the other sets the tooth. Adjustable for various points of saws. Small size for hand, butcher and web saws, etc. Also large size for light-gauge circular saws.

**(10) Disston Try Squares.** Made from well-seasoned lumber to prevent warping and cracking. Blades made of spring steel accurately finished and graduated. Heavy Brass face firmly secured to the stock.

**(11) Disston Compass Saws.** Indispensable in class room, home or mechanic's kit. Screws all the way through handle and blade fastened with flush nut.

**(12) Disston Adjustable Plumb and Level.** Quick and simple of adjustment, at same time accurate. No springs to get out of order. Slight turn of a screw will set the bubble true, if level has been disturbed. Not affected by climatic conditions. Complete assortment.

**(13) Disston Mill Files.** We know what a file should do as well as how to make them. About 35,000 dozen files are annually consumed by our workmen in the manufacture of Disston Saws.

**(14) Disston Chromol Hack Saw Blades.** Possess extraordinary durability. They are made from special alloy steel, mill teeth and set with raker tooth to obtain greatest ease and clearance in cutting.

***Disston Saws and Tools are sold by progressive dealers everywhere. Write to us for information on the tools in which you are most interested.***

**HENRY DISSTON & SONS, Inc.**
**PHILADELPHIA, U. S. A.**
*"America's Largest and Longest Established Makers of Hand Saws, Cross-Cut Saws, Band Saws, Circular Saws, and Tools"*
***Canadian Works: Toronto, Canada***

## A Flower-Pot on a Birch-Tree Stump

WHEN a weeping birch died, its owner decided that the white bark would look well made over into a rustic flower-tub for the lawn. He cut the tree off about 18 in. from the ground, and mounted a small tub on

**Now is the time to turn that old tree-stump into a flower-pot so that it will be ready for spring**

the stump. A large pail would have answered the purpose equally as well.

The branches of the birch he split lengthwise, and nailed the halves vertically against the side of the tub, pointing the projecting ends both above and below. With four smaller branches he tied the bottom of the tub more firmly on to the base of the tree.

The receptacle now being ready, its builder filled it with rich soil from the garden and planted it with spring flowers, changing these to summer and autumn varieties with the different seasons. On account of the upstanding fringe of birch, long-stemmed flowers look best in this receptacle. Even without plants, the bright color of the bark makes this vase-like contrivance a very striking ornament against the green lawn.—C. L. MELLER.

## Old Files Make Good Ice-Picks for the Refrigerator

WORN-OUT files are discarded by the thousands every year; and yet, there are countless ways in which they might be used.

On account of the fine steel used in a file, an ice-pick can be made that will be as good as any manufactured product.

If you have an old 8-in. three-cornered file, grind it smooth on an emery wheel, at the same time rounding off the sharp corners and bringing out a good point on its end.

Leave the ferrule in its original shape, and when the grinding is finished, place the handle just as you would on a file.—H. F. NEFF.